

FINAL

I-95 & SR 896 **INTERCHANGE PROJECT**

I-95 AND SR 896 INTERCHANGE PROJECT VALUE ENGINEERING STUDY

DelDOT Contract No. T201609002

Federal Aid Project No. IM-N060(44)

Delaware Department of Transportation

VE Sessions: March 16, 2020 - April 28, 2020

VE Implementation Meeting: June 25, 2020

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EXECUTIVE SUMMARY

This report presents the findings from a Value Engineering Study conducted for the I-95 and SR 896 Interchange Project (the Project). DelDOT defines the Project's purpose and need as follows: to improve the safety and traffic operations of the I-95 and SR 896 interchange in order to maintain mobility for local and through traffic, while not adversely affecting the operational performance of the I-95 Newark Toll Plaza. The project is focused on improving the I-95 level of service affected by the merging and diverging of through and entering/ exiting traffic. In addition, there is a focus on the reduction to the amount, frequency, and severity of crashes. Between February 2017 and February 2020 there were 527 crashes and two fatalities.

This Value Engineering Study (the Study) was required under the Federal Highway Administration's (FHWA) Value Engineering Final Rule, which is detailed in Title 23 Code of Federal Regulation (CFR) part 627. The authority for the Value Engineering Process is the Delaware Department of Transportation (DelDOT). This study was completed following the DelDOT Policy Implement D-05, 23CFR Part 627.

The Design Team completed the preliminary design of the project on February 12, 2020, prompting DelDOT to initiate the FHWA required Value Engineering Study. This study had an introductory information session on March 16, 2020. The team reassembled on April 27 and 28, 2020, through a virtual presentation to complete the investigation, function analysis, creative, evaluation, and development phases of the Value Engineering Study. This report is meant to detail the findings and assist DelDOT during its presentation to FHWA.

During the study, the Value Engineering Team (VE Team) discussed the functions of the preferred alternative and the ways in which the improvements meet the purpose and need of the project. These functions included:

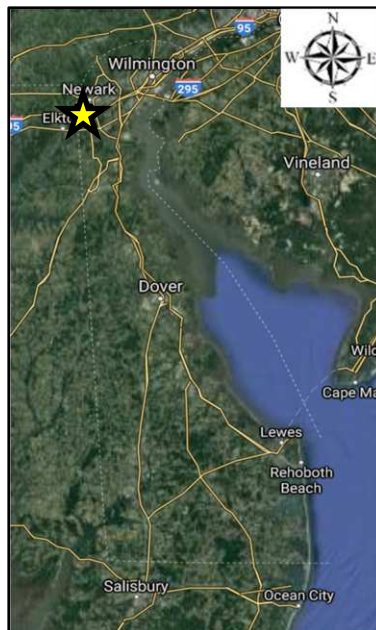
- Provide Multi-modal Access
- Improve Level of Service (LOS)
- Improve Constructability
- Preserve Existing System
- Manage Drainage and Stormwater
- Complete on Budget
- Optimize Material Costs

The Value Engineering Team focused on options that could enhance project quality, mitigate cost or add value to the project, reduce risk, and lessen the overall time of construction and impact to the traveling public. The complete findings of the Value Engineering Study, including both suggested design alternatives as well as recommendations for good practice are included in this report. The report concludes with a decision summary that is organized by function, shows net benefits for each option, and provides a decision matrix for reference by DelDOT.

I. ABSTRACT AND PROJECT LOCATION

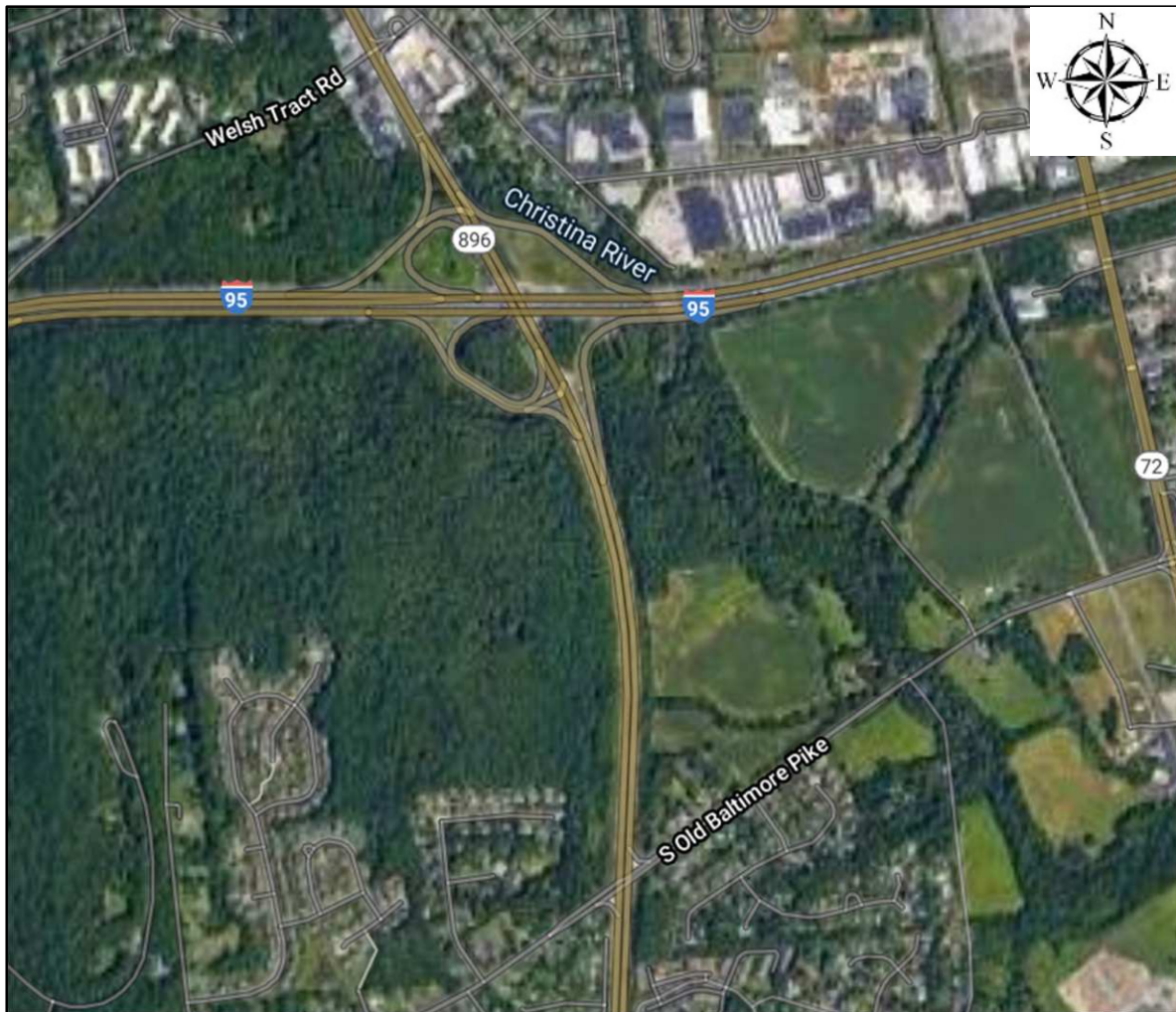
The existing I-95 and SR 896 interchange has several deficiencies that have prompted discussions about making improvements to its configuration. These improvements to the interchange have become increasingly necessary as traffic volumes continue to increase, crashes continue to rise, and LOS continues to worsen. The Project is currently in the design phase. As part of the design process, a Value Engineering Study was performed at the Preliminary Plan Submission. The Preliminary Plans were submitted on February 12, 2020. The Final Plans are scheduled for completion in October 2021. The PS&E approvals from the FHWA are planned to be complete in April 2022, and construction is planned to begin in 2023, pending funding availability and in coordination with planned construction at SR 896 and Old Baltimore Pike. The I-95 and SR 896 Interchange Project is located on the southern limits of Newark, Delaware approximately two miles south of Main Street as shown in Figure 1.

Figure 1: I-95 and SR 896 Project Location



The project limits on I-95 begin east of Welsh Tract Road Bridge and extend east past SR 72 (South Chapel Street). On SR 896, the project limits begin just north of Welsh Tract Road and extend south to Old Baltimore Pike. The project limits exclude staging areas. A project area map is shown in Figure 2.

Figure 2: I-95 and SR 896 Project Area Map



The alternatives and recommendations developed through the Study that the VE Team believes potentially add value for the Improvements being considered at the I-95 and SR 896 Interchange are listed for DelDOT's consideration in Section IX of this report.

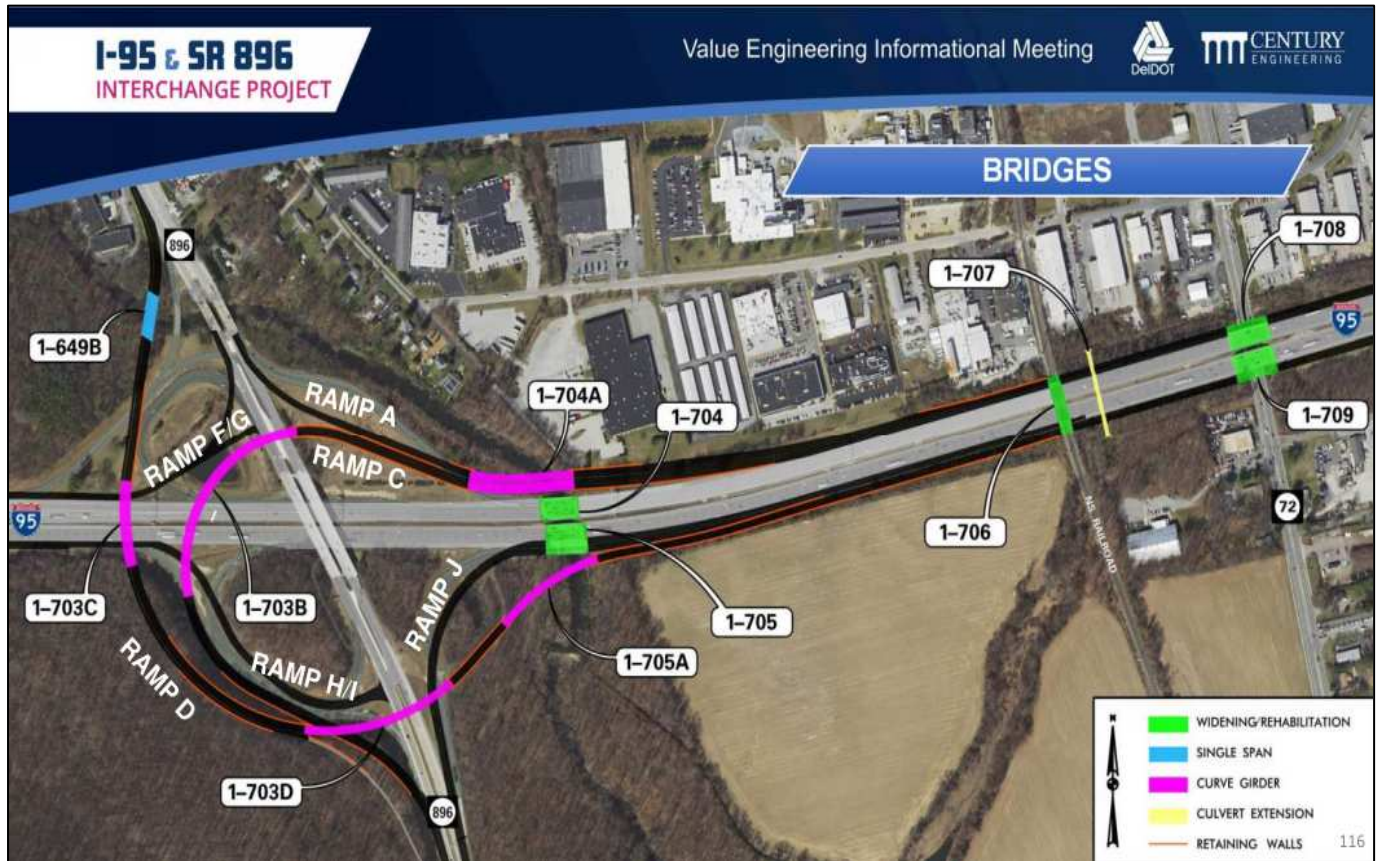
II. PROJECT DESCRIPTION

The Project is located at the interchange of I-95 and SR 896 south of Newark, Delaware. The Project's purpose is to improve safety and traffic operations through the interchange by implementing changes that reduce congestion and crashes and to accommodate the anticipated growth in traffic. There are several constraints associated with the project location that factored into the design and the preferred alternative selected by the Design Team. These constraints include Iron Hill Park to the west, Cooch's Bridge Historical District to the east, Welsh Tract Baptist Church and Cemetery to the north, and the Christina River, which crosses under both I-95 and SR 896. The preferred alternative selected by the Design Team is a Double Flyover Interchange.

The Project elements, shown in Figure 3, include:

- Construction of (2) flyovers involving (6) new bridge structures;
- Widening of I-95 east of SR 896, including existing bridge structures over Norfolk Southern Railroad and SR 72 (1-706, 1-708 and 1-709) and extension of the existing box culvert structure between Norfolk Southern and SR 72 (1-707);
- Rehabilitation of existing bridge structures 1-704 and 1-705 over the Christina River and 1-708 and 1-709 over Route 72;
- Realignment of existing ramps in all four quadrants of the interchange;
- Addition of a shared use path crossing I-95 along Ramp D;
- Construction of (16) retaining walls, including 126,600 square feet of mechanically stabilized earth walls, 13,500 square feet of structural walls, 1,270 linear feet of bifurcated double face barrier walls, and 900 linear feet of single face concrete barrier walls.

Figure 3: Preferred Alternative –Double Flyover Interchange



The Preliminary Plans show five construction phases to be performed over a duration of 1088 calendar days summarized as follows.

- Phase 1: (361 Calendar Days) Detour Ramp H/I | Maintain Ramp J
- Phase 2: (225 Calendar Days) Detour Ramp H/I | Open Temp Ramp A & Ramp J
- Phase 3: (244 Calendar Days) Detour Ramp H/I | Open Ramp A
- Phase 4: (196 Calendar Days) Detour Ramps H/I & F/G | Open Ramp C
- Phase 5: (92 Calendar Days) Detour Ramps H/I | Open Ramps D & F/G
- Project Completion: Open Ramp H/I

Phase 1: (361 Calendar Days) - Detour Ramp H/I | Maintain Ramp J

In Phase 1, I-95 northbound and SR 896 northbound will be widened and Ramp J and temporary Ramp A will be constructed. Existing Ramp H/I will be detoured and the Iron Hill portion of Ramp C and Ramp D, south of I-95 northbound, will be constructed. Portions of Ramp D including the structure over SR 896 and the structure adjacent to I-95 northbound over the Christina River will also be constructed.

Phase 2: (225 Calendar Days) - Detour Ramp H/I | Open Temp Ramp A & Ramp J

In Phase 2, temporary Ramp A will be open to traffic and permanent Ramp A and the Ramp A/C diverge will be constructed. I-95 southbound will be widened and the SR 896 median reconstruction south of the interchange will take place.

Phase 3: (244 Calendar Days) - Detour Ramp H/I | Open Ramp A

In Phase 3, Ramp A will open and temporary Ramp A will be removed. The Ramp C flyover will be completed, the Ramp D structure over I-95 will be constructed, and SR 896 southbound will be widened.

Phase 4: (196 Calendar Days) - Detour Ramps H/I & F/G | Open Ramp C

In Phase 4, Ramp C will open, and existing Ramp F/G will be detoured. Ramp F/G will be constructed, and the Ramp D flyover will be completed.

Phase 5: (92 Calendar Days) - Detour Ramps H/I | Open Ramps D & F/G

In Phase 5, Ramp D will open, Ramp H will be constructed, and mainline SR 896 and I-95 will receive a mill and overlay.

Through each phase, existing Ramps C and D will be maintained until the new ramps are complete. Not included in the preliminary phasing plan is the added bridge maintenance work to rehabilitate existing bridges over the Christina River (Bridges 1-704 and 1-705), and over Route 72 (Bridges 1-708 and 1-709) which includes replacement of concrete parapets, concrete overlays and replacement of joints.

III. TEAM MEMBERS AND RESOURCE PERSONS

Value Engineering Team		
Name	Employer	Role
Sarah Powell	DelDOT	VE Team
William Pines	MDTA	VE Team
Paul Moffitt	AECOM	VE Team
Kevin Lindell	DelDOT	VE Team
Javier Torrijos	TORREngineering	VE Team
Adam Weiser	Whitman, Requardt & Associates	VE Team
Daniel Montag	FHWA	Advisor
John Caruano	DelDOT	VE Coordinator
Maureen Kelley	DelDOT	VE Coordinator
Megan Clayton	Pennoni	VE Co-Facilitator
Ryan Ebner	Trauner Consulting Services	VE Co-Facilitator
Brittany Salmon	Trauner Consulting Services	VE Scribe
Design Team		
Name	Employer	Role
Breanna Kovach	DelDOT	Group Engineer
Brad Damtoft	DelDOT	Project Manager
Steve Penozza	Century Engineering	Project Manager
Kate Smagala	Century Engineering	Highway Engineer
Barry Benton	GPI	Bridge Team Manager
Matt Allen	Wallace Montgomery	Traffic Engineer
Team Partners		
	McCormick Taylor	Lighting, Detours, and Signing & Striping
	Navarro & Wright	Geotechnical Engineering
	Rybinski Engineering	ITMS Design & TMP

IV. PREFERRED ALTERNATIVE SELECTION AND VALUE ENGINEERING INITIATIVES TO DATE

The Design Team evaluated the existing conditions and constraints and identified three design alternatives for further study. These three alternatives were presented at a public workshop in December 2017. Alternative 1 was a Double Flyover Interchange. It resulted in no impact to Iron Hill Park and required no right-of-way acquisitions. Alternative 2 was a Single Flyover Interchange. It required ramp realignments, resulted in impacts to Iron Hill Park and required partial right-of-way acquisitions of three parcels. Alternative 3 was a Modified Diverging Diamond Interchange. It included several ramp realignments, resulted in impacts to Iron Hill Park and required partial right-of-way acquisitions of three parcels. All of the proposed design alternatives improved the traffic operational efficiency of the interchange, but Alternative 1 provided the best improvement in operation and level of service. The Design Team provided a Preliminary Impacts Matrix that summarizes factors considered in the preferred alternate selection process. The matrix is shown in Figure 4:

Figure 4: Preliminary Impacts Matrix

ITEM	ALTERNATIVES		
	1 Double Flyover	2 Single Flyover	3 Modified DDI
Wetlands (Acres)	1.4	1.0	1.6
Forest (Acres)	13	25	22
Right-of-Way (Parcels)	0	3	3
Iron Hill Park*	No	Yes	Yes
Coochs Bridge Battlefield*	No	No	No
Traffic Operational Efficiency	Best	Better	Good
Estimated Project Cost	\$141 M	\$135 M	\$124 M

The double flyover alternative was chosen because it is the most beneficial to the transportation environment while reducing effects on cultural and natural resources. It was also the only alternative that could be constructed without a right-of-way acquisition. Alternative 1 does involve limited property impacts on SR 896 requiring some temporary and permanent easements for construction of the shared use path, but the alternative does not require fee acquisitions. During the December 2017 public workshop, 43 percent of the 137 attendees polled indicated that Alternative 1 was their preferred alternative.

The Design Team identified the following positive attributes of the double flyover interchange:

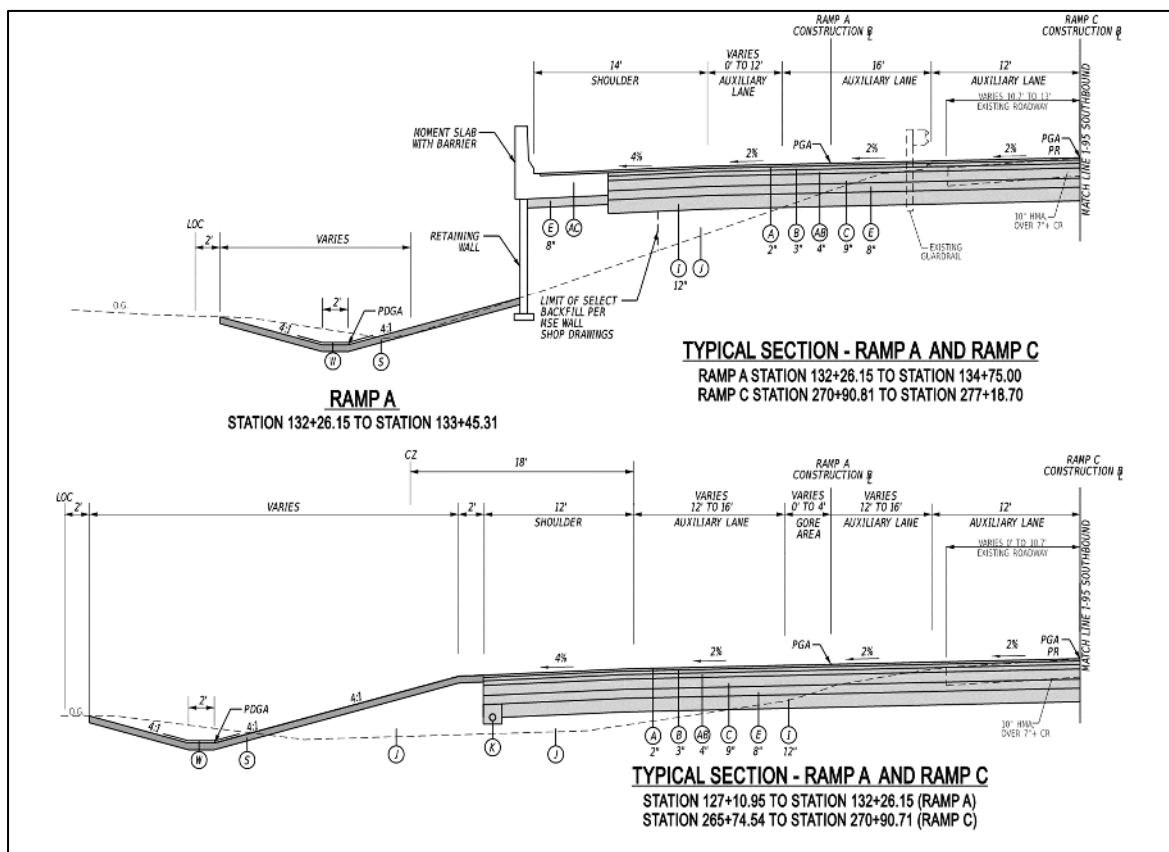
- Separates through traffic on Southbound I-95 from exiting SR 896 traffic
- Eliminates heavy weave movements at Ramp C and D on SR 896 Bridge
- Improves diverge and merge congestion on Ramp J
- Meets parameters identified in existing condition constraints

The I-95 and SR 896 Design Team and DelDOT have considered Value Engineering concepts during the planning and preliminary design of the project and have implemented several value engineering efforts to date. The following efforts were summarized by the Design Team during the information session on March 16, 2020:

- Ramp C profile was raised to allow a deeper superstructure for Bridge 1-703B, reducing from a 5-span structure to 4-spans;
- Ramp D profile was balanced to minimize rock excavation and eliminate impacts to Iron Hill Park;

- Bridges 1-704A & 1-705A were revised from single span to multi-span structures to mitigate geotechnical concerns;
- Ramp A and Ramp C were combined to construct a major portion of the embankments together (See Figure 5);
- Temporary Ramp A was included to avoid the need for a major detour.

Figure 5: Shared Embankment Ramp A and Ramp C



After discussion of alternatives, the VE Team was in consensus that the selected alternative, the double flyover, was operationally the best option. The Team agreed this option was best suited to address the desire to reduce the impacts to Iron Hill, provide access to non-motorized vehicles, and improve the commuter experience.

V. VALUE ENGINEERING AGENDA AND MATERIALS PROVIDED

The VE Team provided agendas for both the information session on March 16, 2020, and the study sessions on April 27 and 28, 2020. Those agendas are included as Appendices A and B of this report.

The following information and materials were provided to the VE Team for the purposes of this study:

Information/Materials Provided		
Item Description	Provided by Century Engineering	Provided by DelDOT
Project Introduction Pamphlet	X	
Traffic Operation Analysis Report	X	
GPI TS&L – Bridges 1-703B, 1-703C, 1-703D	X	
WM TS&L – Bridges 1-649B, 1-704A, 1-705A	X	
I-95 Design Criteria Form	X	
SR 896 Design Criteria Form	X	
Ramp Design Criteria Form	X	
Preliminary Cost Estimate	X	
DelDOT Value Engineering Policy		X
Preliminary Plans	X	
Concept Phasing Plans	X	
Value Engineering Agenda		X

VI. INVESTIGATIVE PHASE

The objective of the Investigative Phase is to obtain an understanding of the design to be studied and to assess the major functions, cost, and value in effectively meeting the goals established for the intersection improvements. For the I-95 and SR 896 Interchange Project, the Design Team had completed the Preliminary Plan Submission.

The Design Team provided the VE Team with the preliminary project plans, specifications, design criteria, project data, proposed schedule, cost estimate, and preliminary design reports before the Value Engineering Study. On March 16, 2020, the Design Team presented an overview of the design parameters, assumptions made, potential alternatives considered to date, and work completed to date for the project. This information was again reviewed by the Value Engineering Facilitators at the beginning of the study session on April 27, 2020. Figure 6 summarizes the design criteria information provided by the Design Team.

Figure 6: Design Criteria

Road Name	Functional Classification	Design Speed	Lane Width	Inside Shoulder Width	Outside Shoulder Width
I-95	Interstate	70 mph	12 Feet	Varies (match existing)	12 Feet
SR 896 – North of Interchange	Principal Arterial	40 mph	11 Feet	> or = 1 Foot	> or = 1 Foot
SR 896 – South of Interchange	Principal Arterial	55 mph	12 Feet	< 4 Feet (match existing)	10 Feet

The documents and input provided by the Design Team served as the basis for the review performed by the VE Team. The VE Team considered this information in identifying the needed functions that would address community and environmental commitments, safety, reliability, efficiency, and overall life-cycle cost. The functions are used to determine alternatives that would improve the value and quality of the project and reduce the time to develop and deliver the project.

The functions needed to be organized in a way to allow the VE Team to evaluate major elements of the project. As the VE Team began to break down the elements into the essential functions of the project, it became clear that the majority of them fit into one of seven categories:

- Provide Multi-modal Access
- Improve LOS
- Improve Constructability
- Preserve Existing System
- Manage Drainage
- Complete on Budget
- Optimize Material Costs

All functions identified by the VE Team were placed into one of these seven categories and tracked on the Value Engineering Function Analysis Worksheet. The worksheet contains verb and noun agreements for each function. The worksheet is included as Appendix C of this report.

VII. SPECULATION PHASE

In the Speculation Phase, the VE Team used the brainstorming method to generate ideas for performing the functional analysis within the previously identified project categories. The ideas considered to potentially improve performance, reduce risks, enhance quality, or lower project cost while still achieving the required functions of the project are summarized as follows:

Ideas by Function Categories

1. Provide Multi-modal Access

- Reduce shared use path width from 12 feet to 10 feet
- Eliminate shared use path on Ramp D since north/south bicycle traffic has access on an existing path along the Route 72 corridor

2. Improve Level of Service

- Utilize diamond configuration on SR 896 to eliminate unsignalized left hand turn movement

3. Improve Constructability

- Consider alternative phasing and maintenance of traffic (MOT) schemes to maximize work area within phases, reduce risks by allowing more time for certain work activities (e.g. bridges with in-stream restrictions, etc.), and reduce weave movements such as:
 - Use of all-electronic tolling during construction
 - Early action for Temporary Ramp A
 - Ramps F/G Detour at beginning of project to maximize work area
 - Advance construction phasing of bridges 1-649B and 1-704A

- Advance construction phasing of existing bridges
- Reduce number of temporary lanes required on I-95 to allow for outside widening and inside pier construction in a single phase
- Reducing SR 896 to single lane in each direction to increase on-site laydown area
- Concurrent phase widening of I-95 northbound and southbound
- Maximize lane closure hours
- Consider precast bathtub forms to avoid geotechnical issues and cofferdams for Bridge 1-705A
- Eliminate/modify Retaining Wall No. 9 located between 1-705A and 1-706 and shown in Figure 7

Figure 7: Retaining Wall Between 1-705A and 1-706



- Consider foundation alternatives at railroad bridge
 - Minimize use of pinned barriers
 - Consider access points when determining barrier (pinned vs unpinned)
4. Preserve Existing System
 - Consider alternate joint detail to move joint off bridge and preserve bearings
 5. Manage Drainage
 - Consider smaller temporary BMPs
 - Consider alternate drainage crossing at I-95
 - Use open drainage where possible
 6. Complete on Budget
 - Remove Item 743542 – Temporary Smart Work Zone
 - Eliminate Ramp J guardrail
 7. Optimize Material Costs
 - Replace wood rail fence with chain link fence

In addition to the above functional analyses, the VE Team determined that the following items were outside of the Value Engineering Study scope but should be considered by the Design Team as recommendations.

Recommendations by Function Category

1. Provide Multi-modal Access
 - No items identified
2. Improve Level of Service
 - Coordinate construction of SR 896 widening south of Interchange

- Consider implementation of all-electronic tolling for the permanent condition
(See Figure 8)

Figure 8: All-Electronic Tolling



3. Improve Constructability

- Consider potential laydown areas at Welcome Center, Toll Plaza, and Star Campus
- Consider alternate project delivery and/or other schedule contractual mechanisms
- Consider technical recommendations regarding bridges

4. Preserve Existing System

- Confirm existing conditions for utilities, drainage, and subsurface conditions
- Evaluate LMC versus PPC overlay for existing bridges

5. Manage Drainage

- Reduce underdrain at select ramps

6. Complete on Budget

- Review need to add Item for RCP flare end section

- Add cost items:
 - Item 302002 – No. 3 Stone
 - Item 302005 – No. 57 Stone
 - Item 602505 – Personal safety grate for pipes over 12-inch diameter
 - Item 708003 – Geotextiles, Riprap
 - Item 905500 – Super silt fence for bridge areas
- Clarify E&S Items:
 - Item 909005 – Stream diversion
 - Item 906003 – Sump pit
 - Item 906002 – Dewatering bags
- Confirm railroad services cost and construction agreement in advance
- Consider contingent Item for pile abandonment

7. Optimize Material Costs

- Review for redundancy between Item 834501 - Partial Removal of Concrete Pole Bases and Cabinet Foundations and Item 211000 -Removal of Structures and Obstructions
- Use alternative materials in fill situations
- Consider substitutes to ultra-high performance concrete (UHPC)

VIII. EVALUATION AND DEVELOPMENT PHASES

In the Evaluation and Development Phase, the VE Team reviewed the ideas identified in the Speculation Phase, developed the ideas, and assigned each a priority. Ideas that did not appear feasible or preferable for further evaluation were eliminated. Discussions and priority assignments are described in detail below, organized by function category. For each item, a discussion of the item, the advantages and disadvantages of the item, and a recommendation as to the potential effectiveness for the item has been provided.

In addition to the Priority Items, the VE Team has identified Team Recommendation Items, by function category, that should be considered or reviewed when completing the project design. These items include good practice recommendations or observations noted by the VE Team, but do not necessarily fall under the intent of the Value Engineering Study. For each item, the recommendation summary has been provided.

Priority Items by Function Category

1. Provide Multi-modal Access

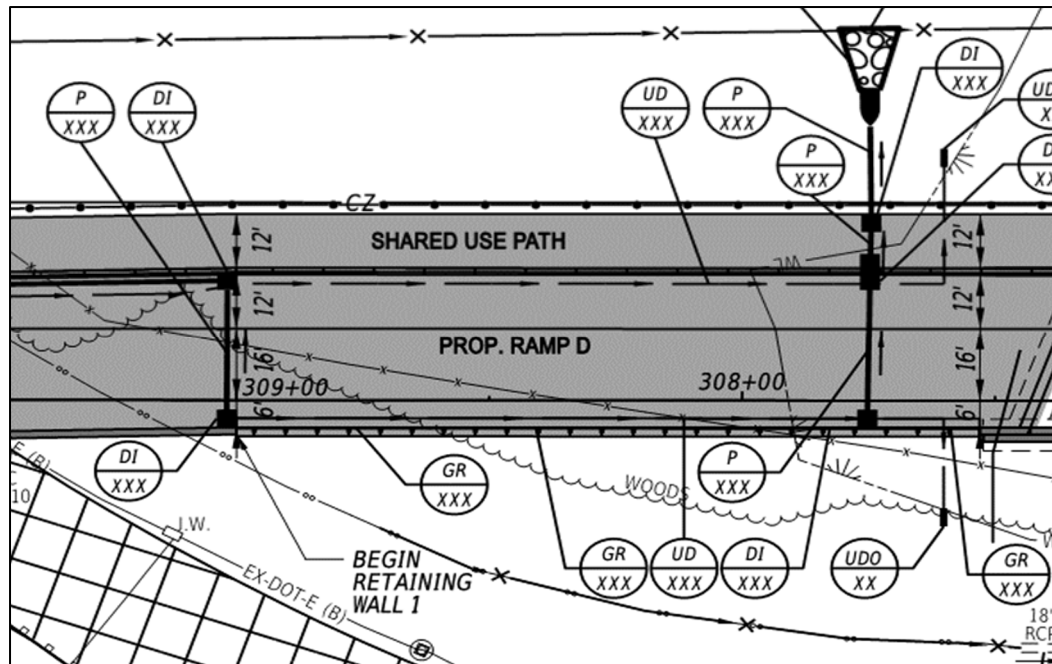
Reduce Path Width from 12 feet to 10 feet (High Priority)

Discussion

The VE Team discussed the shared use path along Ramp D and asked whether it tied into an existing path on SR 896 or included connection access to Old Baltimore Pike. The Design Team noted that the Ramp D shared use path is intended to tie into a not-yet-constructed connection to Old Baltimore Pike proposed in a separate widening project for SR 896 south of the Interchange Project. The existing shared use path connections in the vicinity of SR 72 were also discussed. The Design Team indicated that it considered the existing shared use network around Route 72, but feedback indicated that incorporation of a shared

used path across I-95 was of high public priority for this project. The VE Team concluded that the shared use path should remain on Ramp D and proposed it could be reduced from 12 feet to 10 feet to provide a practical design that meets AASHTO requirements. Figure 9 shows the proposed path width between Bridges 1-649B and 1-703C. The 12-foot width is proposed for over ½ mile or nearly the entire length of the path starting at SR 896 leading into Ramp D, approaching Bridge 1-649B, and continuing through Ramp D across Bridge 1-703C. The shared path splits off from Ramp D just prior to Bridge 1-703D and continues at a 12-foot width for approximately 500 feet before narrowing down to 10 feet to tie into SR 896.

Figure 9: Shared Use Path on Ramp D



The VE Team estimates that reducing the path width can save up to \$250 per square foot across bridge structures and \$90 per linear foot across at-grade sections. The potential savings was estimated as follows:

Location	Distance	\$/Unit	Avg Cost
North of 1-649B	250 LF x 2 LF Sta. 303+00 to 305+50	\$90/LF	\$45,000
1-649B	175 LF x 2 LF	\$250/SF	\$87,500

Location	Distance	\$/Unit	Avg Cost
1-649B to 1-703C	540 LF x 2 LF Sta. 307+50 to 312+90	\$90/LF	\$97,200
1-703C	317 LF x 2 LF	\$250/SF	\$158,500
1-703C to Ramp D split	915 LF x 2 LF Sta. 315+85 to 325+00	\$90/LF	\$164,700
Ramp D split to Narrowing	500 LF x 2 LF Sta 835+00 to 830+00	\$90/LF	\$90,000
		Total	\$642,900

Advantages

- Upholds community expectation for shared path inclusion across I-95.
- Reduces cost.

Disadvantages

- Eliminates 2-feet of buffer area.

2. Improve Level of Service

Refer to Alternative Phasing and MOT Schemes in Item No. 3, Improve Constructability.

3. Improve Constructability

Alternative Phasing and MOT Schemes to Maximize Work Area and Reduce Risks (High Priority)

Discussion

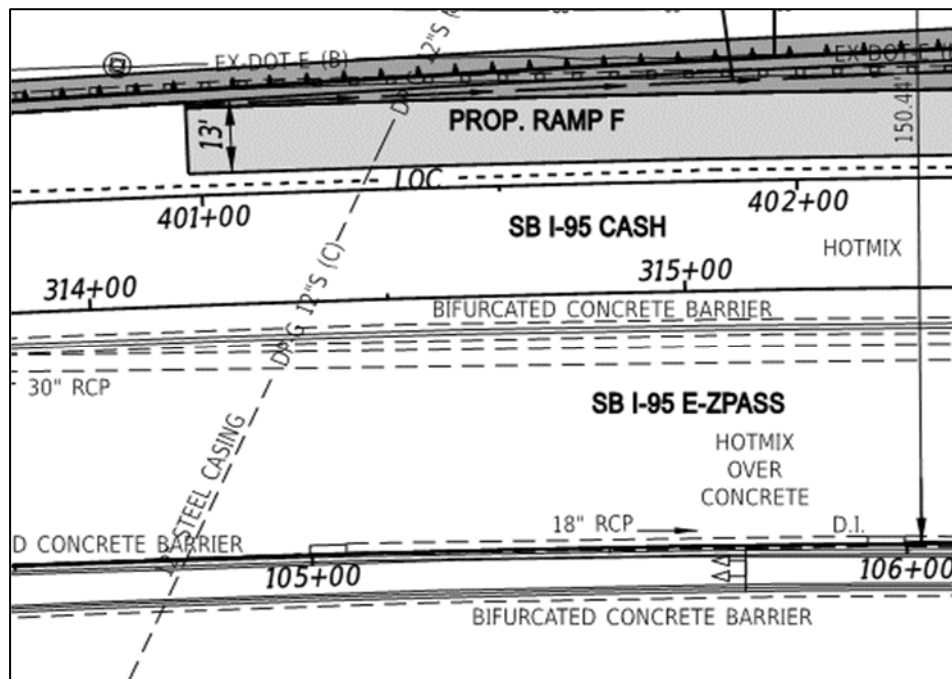
The VE Team discussed several potential alternatives with respect to the phasing and maintenance of traffic that relate to the overall recommendation of maximizing the contractor's work area and access within phases to condense the project schedule and reduce risks. Additional references including a summary of phasing ideas identified in the Speculation Phase discussion and preliminary phasing and project overview graphics presented by the Design Team in the Information Session are included in Appendix D of this Report.

Regarding construction sequence and phasing, it was noted that the current proposed phasing establishes intended sequence of construction for the proposed interchange. Not included is the added bridge maintenance work to existing bridges over the Christina River (Bridges 1-704 and 1-705), and over Route 72 (Bridges 1-

708 and 1-709) which includes replacement of concrete parapets, concrete overlays and replacement of joints. The VE Team noted that there are a number of I-95 phasing constraints, such as temperature restrictions on the existing bridge overlay materials, in-stream restrictions, the asphalt paving season, and motorists access needs. These constraints may drive the project phasing and must be coordinated with the interchange phasing.

Regarding maintenance of traffic, it was discussed that the Welcome Center located north of the interchange is located in the median of I-95 with entry and exit points on the left, opposite of the SR 896 interchange access points. Also, the configuration to access the Newark Toll Plaza located south of the interchange includes bifurcated concrete barrier to separate EZ-pass only lanes, which divides the existing mainline lanes prior to the proposed Ramp F tie-in. Figure 10 shows the toll lane configuration on I-95 at the proposed Ramp F tie-in south of SR 896. These conditions provide added challenges to maintain safe and adequate access for motorists and construction vehicles during construction.

Figure 10: I-95 Lane Configuration at Ramp F Tie-in



It was also noted that the project delivery method has not yet been established. With the project delivery method and many details of the I-95 mainline phasing and maintenance of traffic plan still in development, the VE Team offers several potential alternatives for consideration, but did not attempt to identify the single best combination of alternatives due to the assumptions that would be involved in selecting a single alternative or combination.

The specific alternatives and recommendations discussed for maximizing the work areas are presented under the categories of phasing and maintenance of traffic. The VE Team is confident that there are several feasible alternatives presented that may be combined to result in time savings of six months to one year to the project completion date. The VE Team agrees that the proposed construction duration (approximately three years) does not account for durations of phasing for I-95 mainline bridge work. When considering phasing for I-95 mainline work, the VE Team estimates an approximate 3.5 to 4-year project duration.

The compression of the schedule by fast tracking Ramp C and/or Ramp D and incorporating I-95 mainline work could potentially reduce the project to an approximate 2.5 to 3-year duration with a potential savings of \$10 million dollars considering agency construction management and inspection costs as well as contractor overhead and field costs. This estimate equates to potential savings of approximately \$27,400 per day, which the Value Engineer Team agrees is an appropriate figure to use as a rough order of magnitude estimate. The discussion that established justification for the estimated order of magnitude for potential savings is summarized as follows:

Cost	\$/Day	Days	
Agency CMI	\$1000	365	\$365,000
Contractor Overhead	\$500 to \$1000	365	\$182,500 to \$365,000
Contractor Field Costs	\$20,000 to \$30,000	365	\$7,300,000 to \$10,950,000
		Total	\$7.85 Mil to \$11.68 Mil

This order of magnitude is further supported by DelDOT's recent SR 1 / I-95 Interchange Project which incorporated Item 763564 – Special Bidding

Procedures for A+B bidding and established a cost benefit of \$35,000 per day of early project completion using the following formula to evaluate bids: $A \text{ (total dollar amount for all work to be performed)} + B \text{ (proposed calendar days} \times \$35,000/\text{calendar day)} = \text{Total Bid Value.}$

Phasing Discussion

The VE Team discussed that while the project site is constricted in all four quadrants by various elements including the Christina River, Iron Hill Park, Cooch's Bridge Historical District, and Welsh Tract Baptist Church, and Cemetery, the proposed design provides flexibility with regard to construction phasing options due to the ability to detour the existing lower volume traffic ramps and ability to maintain traffic on existing or temporary higher volume ramps while constructing the flyovers for proposed Ramps C and D. The Team agrees that phasing should consider maximizing work areas for access to Ramps C and D while also considering work areas for structures that will benefit from earlier access due to potential issues that may be encountered during construction.

Prioritization for Ramp C

It was noted that in the proposed phasing, the major congestion issue of the existing Ramp C traffic back-up on I-95 is not relieved until the opening of the Ramp C flyover in Phase 4. One potential alternate phasing plan discussed prioritizes the Ramp C open date and involves constructing temporary Ramp A as an early action item, allowing construction on the southbound widening, proposed Ramp A/C, and the bridges and embankment for the majority of Ramp C to be constructed next and concurrent in cases when the work does not conflict with other construction such as the outside widening of Bridge 1-706. The sequence discussed is summarized as follows:

Early Action:

- Construct Temporary Ramp A

Phase 1A:

- SB I-95 widening
- Ramp A/C

- Ramp A connection to SR 896 NB
- Ramp C bridges and embankment and tie-in to 896 SB
- Close Ramp H/I (for duration of project)

Phase 1B:

- Shift temporary Ramp A to proposed Ramp A and open Ramp A
- Complete Ramp C connection
- Open Ramp C to traffic

Phase 2:

- NB I-95 widening
- All of Ramp D including connection at SR 896 SB
- Close Ramp F/G
- Construct proposed Ramp F/G

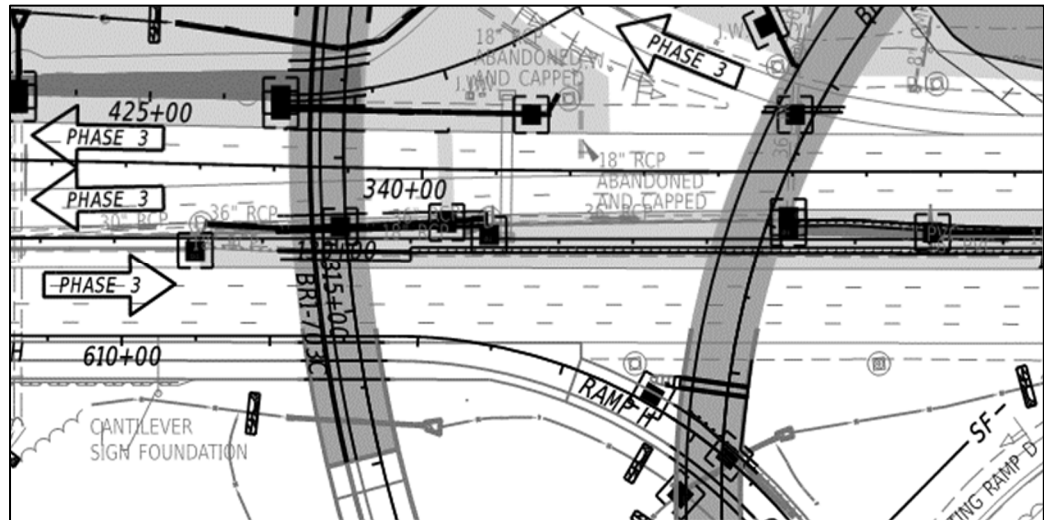
Phase 3:

- Open Ramp D
- Remove existing Ramp D
- Construct Ramp H/I
- Realign Ramp J

Phase 4:

- Mill and Overlay entire limits, except as determined by a detailed I-95 phasing evaluation for the bridge rehabilitation scope

This phasing would result in earlier relief of the congestion point for traffic merging onto 896 southbound from I-95 southbound while giving the contractor a larger area of work to access and enabling more efficient construction to reduce the overall construction time. It does not provide for the benefits associated with progressing the northbound and southbound widening in a single phase, which is addressed later in this section as a separate alternate phasing option. It also does not allow for the benefit of girder setting at Ramp C and D across I-95 in a single phase as proposed in the current phasing plan. Figure 11 shows the proposed coordinated phasing of girder setting across I-95 in Phase 3.

Figure 11: Proposed Phase 3 Girder Setting


Prioritization for Ramp D Concurrent with Ramp C

The Value Engineering Team believes the schedule will benefit from allowing more of Ramp D to progress concurrent with Ramp C. Specifically, the VE Team recommends benefit can be achieved by advancing the Ramp D construction in the northwest quadrant from Phase 4 to Phase 3 to maximize the contractor's work area and access within the Phase. This alternative may increase the duration of detour for Ramp F/G, but it will also likely result in a decrease to the overall duration for construction of Ramp D. It was asked if the alignment of Ramp D can be shifted to the west, to avoid a conflict with maintaining existing Ramp C traffic during construction of Ramp D, but the Design Team noted that the Ramp D design was determined with preference given to minimize rock excavation and impacts to Iron Hill. It was discussed that a short portion of Retaining Wall 1 overlaps with existing Ramp C, so advancing this work has the potential to conflict with maintaining traffic on existing Ramp C, but that temporary barrier and a shoulder width reduction to a portion of Ramp C may allow for construction of this portion of Retaining Wall 1 while maintaining existing Ramp C traffic.

This phasing would open more work area to the contractor enabling greater flexibility to maximize efficiency, mitigate issues or delays encountered during construction associated with Ramp C and Ramp D, and reduce the overall

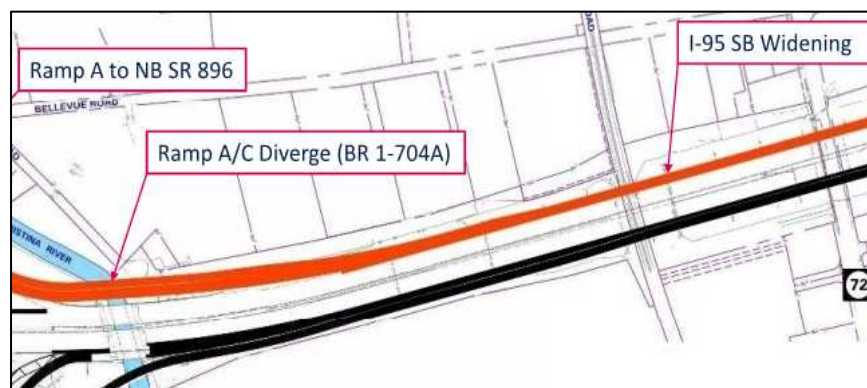
construction time, especially if there is no preference for order of opening of Ramp C versus ramp D. Additionally, a provision could be included to specify that the Ramp F/G detour could not be implemented until the start of the Ramp D work in the northeast quadrant, limiting the extended duration for the detour associated with advancing this work. It also maintains the benefit of proposed girder setting around I-95 in a single phase. A disadvantage of this alternative is that it requires a work around for the construction of Retaining Wall No. 1 if existing Ramp C traffic is to be maintained.

Northbound Widening Concurrent with Southbound Widening

Another phasing option discussed was allowing the northbound and southbound widening to progress in the same phase. It was noted that the current proposed widening in Phases 1 and 2 could progress concurrently rather than sequentially with an interim stage milestone for the opening of Ramp A to avoid potential conflict between Ramp C construction and the temporary Ramp A alignment.

One significant benefit of sequencing this widening together during an early phase is that it would enable earlier access to Bridge I-706 over Norfolk Southern, which may be difficult to construct due to the existing structure foundation and associated railroad constraints for this work. The Team recommends phasing this bridge work as early as possible to allow more opportunities for mitigation should delays be incurred. Figure 12 shows proposed Phase 2 southbound widening to occur following completion of the proposed Phase 1 northbound widening.

Figure 12: Phase 2 Proposed Southbound Widening



I-95 Mainline Work

The phasing for proposed resurfacing and median barrier replacement work at all existing structures on I-95 was also discussed. It was agreed that resurfacing and barrier work should be sequenced with corresponding widening and median activities. It was noted the natural outside-in progression sequence of the recommended priority widening work to be completed east of the interchange conflicts with the natural inside-out progression of the recommended priority median work associated with the Ramp D pier construction located west of the interchange. Maintenance of traffic recommendations in conjunction with revised phasing may help address the potential conflict in natural progression sequence for the priority work items of I-95 widening and 1-703C pier construction.

The temperature sensitive nature of the resurfacing work was also discussed as a reason to advance the I-95 mainline work and allow work on mainline I-95 bridges to commence earlier than Phase 5. Additionally, it is recommended that the project will benefit from advancing Bridges 1-708 & 1-709, however this recommendation needs to be considered in conjunction with the split phasing discussion detailed below in the Maintenance of Traffic Discussion.

Bridge Structures Across Christina River

Finally, it was recommended to give priority phase consideration to structures crossing the Christina River to mitigate potential delay issues with in-stream construction restrictions. This objective could be achieved through implementation of some previously discussed alternatives including prioritization for Ramp C and widening of northbound and southbound I-95 in a single phase.

The VE Team also noted constructability concerns identified in the information session for 1-705A, the Ramp D bridge over the Christina River approaching I-95 northbound. The VE Team recommends considering putting footings near ground level or using floating (bathtub) footings to avoid complex cofferdams, especially if using driven piles and scour counter measures.

*Maintenance of Traffic Discussion*Split Traffic Condition

The VE Team discussed the complexities of the maintenance of traffic needs. If a split traffic condition is being considered for I- 95 bridge work, it was noted that maintaining access for the SR 896 ramps will be more difficult in a split condition configuration due to the curve west of the Welcome Center and distances of barrier separation for the phases. The VE Team recommends careful consideration to the phasing and safety implications of split traffic conditions on I- 95 with regard to the SR 896 ramp movements, access to cash toll lanes, and construction entry/exit from work zone. The VE Team recommends the Design Team consider including requirements in the Contract related to Contractor re-entry to the highway during the split phases, such as requiring an adjacent lane closure, if applicable.

Temporary Lanes Required on I-95

One recommendation that may be used in conjunction with revised phasing recommendation to maximize the work zone and availability of work within phases is reducing the number of temporary lanes required on I-95. It is recommended to evaluate either reduction of an entire lane or reduction of lane widths if reduction of a lane is not possible. Reduction of the temporary lanes may allow for I-95 outside widening and inside Ramp D pier construction to occur in a single phase.

All-Electronic Tolling during Construction

It is also recommended to evaluate use of all-electronic tolling at the Newark Toll Plaza during construction. This will eliminate the need to maintain access to cash lanes and reduce the number of temporary weave conditions required in the maintenance of traffic plan. While there are many considerations to be evaluated with implementing all-electronic tolling, it may allow much more flexibility in the maintenance of traffic plans for the work on I-95 mainline and allow more areas of work to be open in a single phase, thereby reducing the overall construction time. With the large amount of work located in a concentrated area for this project, providing a large area of work to access in a single phase is likely to yield great benefit the overall project duration.

Temporary Lanes on SR 896

If other recommendations related to increasing the work zone for I-95 are not possible, the VE Team recommends reducing SR 896 to single lane in each direction across the bridge and making the resulting area available an on-site laydown area. If phasing is revised to maximize potential work areas, it will be important to include adequate laydown areas to maximize the schedule benefit realized.

Traffic Maintenance for I-95 Drainage Crossing

The VE Team discussed girder setting for structures across I-95 and recommends that the drainage crossing to the wet pond in the Ramp C infield be evaluated for incorporation into closures for girder setting, if it cannot be rerouted to the existing drainage crossing. Pipe depth and rock elevation would need to be considered to determine if feasible to excavate, install, backfill and pave in sections under a single closure shift. It is recommended to allow staggered lane closures down to a full closure to maximize the work zone that can be accessed in an overnight closure shift.

Eliminate/Modify Retaining Wall Between 1-705A and 1-706 (High Priority)

Discussion

The VE Team recommends reducing the length of Retaining Wall 9 between Structure 1-705A across the Christina River and Structure 1-706 across the Norfolk Southern Railroad. As proposed, the retaining wall runs continuous between the two structures. The purpose of the retaining wall is to enable the limit of construction to remain inside the existing right-of-way. The VE Team suggested that a right-of-way acquisition may lower costs, and be worth considering in this instance to allow an approximate 1000-foot reduction of retaining wall structure, and that a reinforced slope wall may allow for reduction of cost with minimal right-of-way required as opposed to a typical embankment slope. An estimated cost for MSE wall construction of \$70 per square foot was determined based on historical data. The cost reduction for the elimination of approximately 1000 feet of Retaining Wall 9 at an average height of 20 feet is estimated to be \$1,400,000. The cost

savings to construct a reinforced soil slope wall in place of a traditional MSE wall is estimated at \$700,000. This is based on Transportation Research Record 1288 which estimates that a reinforced soil slope in place of a traditional MSE wall can produce a 50% savings in cost. A conventional slope embankment with a 2:1 slope and a 10-foot area at the toe of slope, could result in just over an acre of right-of-way acquisition and an estimated cost of \$500,000 to \$700,000. Therefore, the Value Engineering Team estimates a net \$700,000 cost savings to modify Retaining Wall No. 9 in favor of either a reinforced soil slope or conventional slope embankment.

Advantages

- Reduces overall cost.

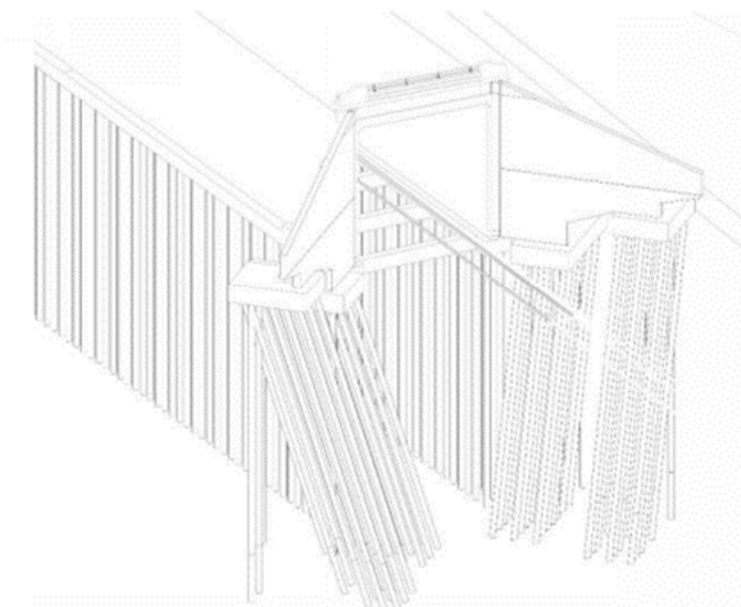
Disadvantages

- Requires potential right-of-way acquisition and /or construction easement agreement.
- Would involve additional Environmental Site Assessment and has potential historical and archaeology considerations as part of Cooch's Bridge Historic District.

Consider Foundation Alternatives at Railroad Bridge (High Priority)

Discussion

The VE Team recommends reducing the number of drilled shafts by considering micropiles as an alternative for the foundation for the widening of the Structure 1-706 over Norfolk Southern. There are several existing piles and battered piles that will likely cause conflict during the proposed drilled shaft caisson installation. Figure 13 shows the rendering of the existing pile layout at Bridge 1-706.

Figure 13: Rendering of Existing Pile Layout at 1-706

At a minimum, the VE team recommends that subsurface exploration is performed to verify that conflicts with existing piles can be avoided with the drilled shaft concept. Use of micropiles may provide added flexibility therefore reduced costs in overcoming these conflicts as compared to a drilled shaft caisson. Additionally, the equipment required for the drilled shaft construction may be difficult to maneuver around the high mast electric lines. The VE Team agreed that the cost of micropile foundations versus drilled shaft foundations is relatively comparable. DelDOT Contract T201407601 included Item No. 619520, Drilled Micropiles, which was bid at \$200 per linear foot. Associated load testing was bid at \$2000 per test. Assuming that it would require approximately four micropiles to achieve a capacity comparable to a 42-inch drilled shaft caisson, the relative cost of micropiles is estimated at \$800 per linear foot compared to \$1300 per linear foot estimated for a 42-inch drilled shaft caisson. When the cost of load testing is factored in, the initial price of micropiles may be comparable or slightly higher compared to caissons, depending on the number of load tests required, but field changes may be less costly to address with micropile foundations. Therefore, for purposes of this evaluation, the VE Team assigned a

negligible cost difference to this alternative, but believes it is worth pursuing from a risk mitigation and time savings benefit.

Advantages

- Micropile equipment is easier to maneuver in limited access spaces and may provide more flexibility in maneuvering around high mast electric lines.
- Micropiles are easier to abandon and relocate if conflicts with existing piles are encountered.

Disadvantages

- Require many piles to achieve similar capacity to drilled shaft caissons.
- May require additional boring information.

Minimize pinned barriers (High Priority)

Discussion

The proposed plan contains pay items for pinned barrier but not for unpinned barrier. The VE Team recommends minimizing use of pinned barrier and using unpinned barrier where possible to reduce overall barrier costs. Unpinned barrier will also be more cost effective with regard to construction entrance access points and changes to construction access points throughout construction. The VE Team recommends that the pinned barrier be limited to the areas required by standard where adequate deflection zone cannot be achieved to prevent a drop-off. It was estimated that approximately only 10 percent of the barrier requires pinning and using unpinned barrier will result in a cost savings of up to \$40 per linear foot compared to pinned barrier. Considering the planned quantities contained in the preliminary cost estimate for pinned concrete barrier and pinned asphalt barrier, it was assumed for the sake of estimating that all 18,950 linear feet of planned pinned asphalt barrier, could be specified as unpinned barrier for an estimated cost savings of \$758,000 (18950 LF x \$40/LF). Note that the cost savings from unpinned barrier may be magnified when the I-95 sequencing and MOT for existing bridge resurfacing and barrier work is developed. This may also be a risk to transfer to the Contractor by requiring the Contractor to determine when at-grade pinned barrier is required to establish safe working conditions.

Advantages

- Most cost effective.
- Easier to move/modify.

Disadvantages

- Increased deflection zone requirements.
- Potential worker safety disadvantages in work zone areas with limited space.

4. Preserve Existing System

Consider Alternate Detail to Move Joint Off Bridge (High Priority)

Discussion

The Design Team confirmed that plans include consideration for future maintenance while minimizing disruption with features such as providing adequate room for a future jacking operation to accommodate bearing replacement. Consistent with 106.6.1 of DelDOT's Bridge Design Manual, the VE Team recommends considering alternate joints details that allow the joint to be moved off the bridge to keep water off bearings and improve the overall life cycle. Sample details were project to the Design Team during the Value Engineering Workshop session. The savings associated with this alternate is the future maintenance savings of a bearing replacement project estimated at approximately \$1.2 to \$1.4 million. This project represents a total of 28 girder lines on 56 bearings and bearing replacement with jacking is roughly estimated at \$20,000 to \$25,000 per bearing. This is supported by a 2005 DelDOT, Contract No. 22-074-098, which included expansion dam bearing replacement on the I-95 bridges within the I-95 and SR 896 Interchange Project limits. Expansion dam and bridge jacking costs totaled \$640,000 with replacement bearing costs ranging from \$1,600 to \$2,200 each, depending on bearing type, and anchor bolt replacement costs of \$180 each. The \$2.6 million dollar project included 140 bearing replacements averaging \$18,500 per bearing in 2005.

Figure 14 shows an example from VDOT's Bridge Manual used on a Maryland project where an alternate joint detail was used for a project involving a curved girder bridge to retaining wall interface similar to the bridge designs proposed for this project.

Figure 14: Holabird Avenue Ramp Replacement using Alternate Joint Detail



Advantages

- Improved life cycle.
- Sample detail available for bridge to retaining wall tie-in.

Disadvantages

- Minor additional formwork costs and width increase.

5. Manage Drainage

Consider Smaller Temporary BMP (Low Priority)

Discussion

The VE Team noted that the size and placement of the permanent BMPs may make staging and access difficult during construction and recommends considering smaller interim management measures be constructed to manage temporary condition and allow final BMP to be constructed at the end.

Advantages

- Increase access for contractor.

Disadvantages

- Additional cost and E&S controls necessary.
- Adds additional E&S phase of construction.

Consider Alternate Drainage Crossing at I-95 (Medium Priority)*Discussion*

The VE Team recommends considering an alternative to the proposed 18-inch RCP I-95 drainage crossing at approximate station 345+40 which releases to the wet pond in the Ramp C infield. The VE Team recommends instead using the existing 36-inch RCP drainage crossing at approximate station 342+50 to carry drainage across I-95. It is noted that there are several unknowns with regarding to the existing pipe and that the condition of the pipe, pipe material and pipe capacity condition will require further review to determine if elimination of the proposed drainage crossing is feasible.

The VE Team noted that the proposed drainage, if required, could be difficult to install by trench method across I-95 without an adequate time frame for detour or lane closures due to the elevation of rock in this location if short-term closures are anticipated for this work and recommends that split traffic conditions in the ramp areas are avoided if long-term closures are anticipated for this work. It was further noted that it may not be feasible to install by jack and bore method based on the rock elevation.

If the proposed crossing is retained, the VE Team recommends that the proposed sequencing allows adequate time to install across I-95 in rocky subgrade conditions. The estimated cost saving for the 18-inch RCP alone is approximately \$7,820 for 92 linear feet at \$85 per linear foot. If assumed that the temporary barrier from the existing bridge work will be extended to include this crossing behind the protected work zone area, an additional \$79,000 savings is estimated, assuming elimination of a 1000-foot barrier extension section. This includes \$30,000 for the initial barrier set, \$24,000 for three barrier resets, and \$25,000 in MOT costs.

Therefore, the total savings is estimated to be \$86,820. If a jack and bore operation was anticipated and eliminated, the cost savings may climb to between \$184,000 and \$200,000.

Advantages

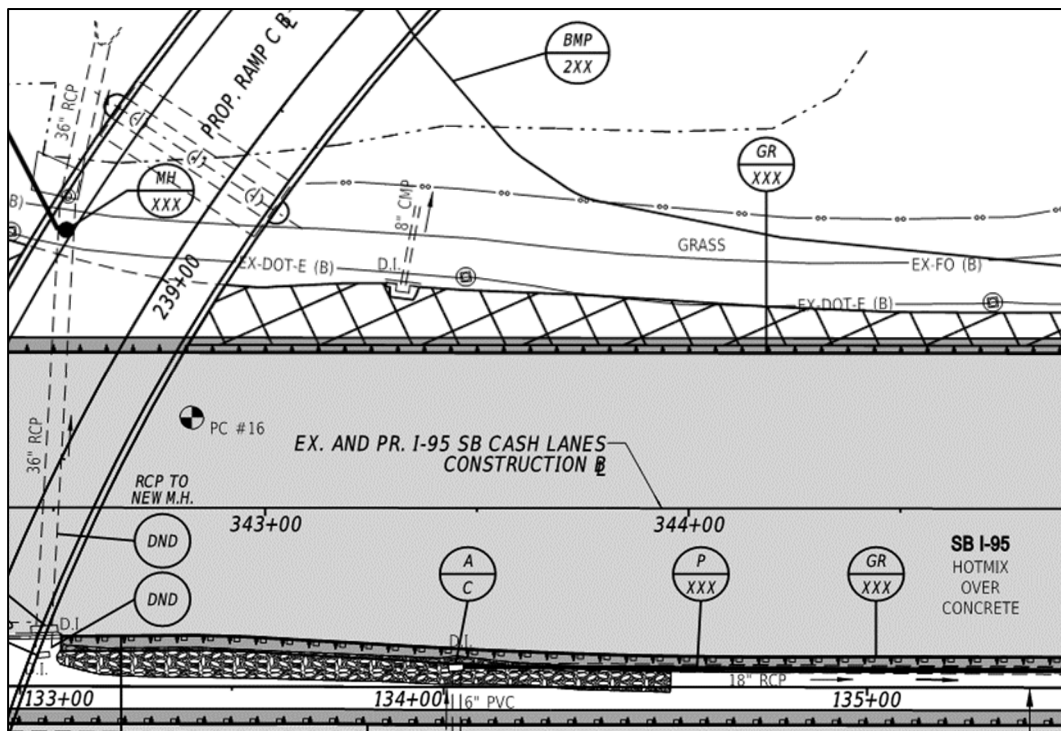
- Using existing drainage crossing eliminates need to coordinate phasing and MOT for new pipe installation across I-95 in rocky subgrade conditions.

Disadvantages

- May not be feasible if capacity or condition of existing drainage pipe does not support drainage need.
- Requires rerouting direction of flow of the proposed median drainage between the existing and the proposed crossings.

Figure 15 shows the existing 36-inch RCP crossing and the proposed 18-inch drainage in the median that connects into the proposed 18-inch drainage crossing at approximate station 345+40 and drains into the Ramp C infield.

Figure 15: Existing 36-in RCP Crossing and Proposed 18-in RCP in Median



Use Open Drainage Where Possible (High Priority)*Discussion*

The VE Team noted that the shared use path includes closed drainage system between station STA 826+00, LT to STA 832+50, LT that may potentially be replaced by open drainage. Open drainage would result in a cost savings of both the construction and maintenance costs. Conversion to open drainage for this area could result in elimination of five inlets and 650 linear feet of RCP and estimated savings of \$74,250.

Advantages

- Cost savings of open drainage versus closed drainage.

Disadvantages

- Need to determine if there was a reason that closed drainage is required.

6. Complete on Budget

Remove Item 743542 – Temporary Smart Work Zone (High Priority)*Discussion*

The VE Team recommends removal of Item 743542 – Temporary Smart Work Zone. While valuable information may be provided through this Item, the increased reliance of road users on navigational applications providing similar information makes this information more accessible through alternate avenues. It was recommended that existing DelDOT owned traffic management equipment be utilized to collect traffic conditions and communicate that information to contractor supplied remote programmable message boards.

Advantages

- Estimated Cost savings of \$250,000.

Disadvantages

- Reduced ability to provide information to road user.

Eliminate Ramp J Guardrail (Medium Priority)

Discussion

The VE Team recommends eliminating the guardrail on the Ramp J outside shoulder if the proposed slope is 6:1 and there are no other extenuating factors necessitating guardrail at this location as the slope condition does not require guiderail.

Advantages

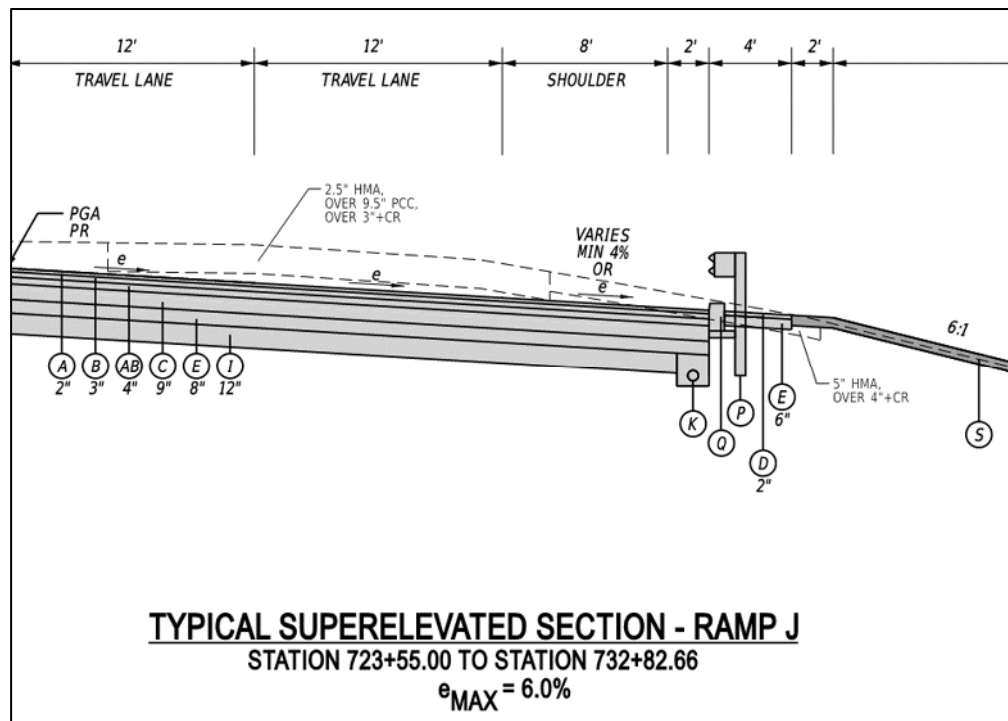
- Estimated cost savings of \$38,500 based on 1,100 linear feet at approximately \$35 per linear foot for construction as well as eliminated need for maintenance.

Disadvantages

- None.

Figure 16 shows the typical section at Ramp J including guardrail for Station 723+55 to Station 732+82

Figure 16: Ramp J Guardrail



7. Optimize Material Costs

Replace Wood Rail Fence with Chain Link Fence (Medium Priority)

Discussion

Item 727002, Wood Rail Fence, and Item 727000, Chain Link Fence, are both included in the Preliminary Cost Estimate. Item 727002, Wood Rail Fence is intended along the shared use path. While there is not a big price difference up front cost for these two items, chain link fences will have a longer life cycle and lower maintenance costs. The VE Team recommends the chain link fence be used in place of wood rail fence.

Advantages

- Improved life cycle cost and reduced maintenance.

Disadvantages

- Chain link fence is less aesthetically pleasing than wood rail fence and may be inconsistent with fencing proposed for connecting trail segment.

Team Recommendations by Function Category

1. Provide Multi-modal Access

- No items identified

2. Improve Level of Service

- Coordinate construction of SR 896 third lane

Recommendation

There is a concern that the improved condition created at the interchange will create a new congestion point at SR 896 and Old Baltimore Pike. The VE Team recommends widening SR 896 south of Old Baltimore Pike. The Design Team noted that a third travel lane and shared use path at this location is currently planned as part of an advanced project but noted that this work could potentially be added to the I-95 and SR 896 Interchange Project. The decision will depend on the project

timeline. The VE Team recommends giving consideration to the interface of the project limits and associated revised striping, rumbles strips, etc. if completed as separate projects. It is also important to include the accompanying bike path in this project or include as a separate project.

- Evaluate permanent all-electronic tolling

Recommendation

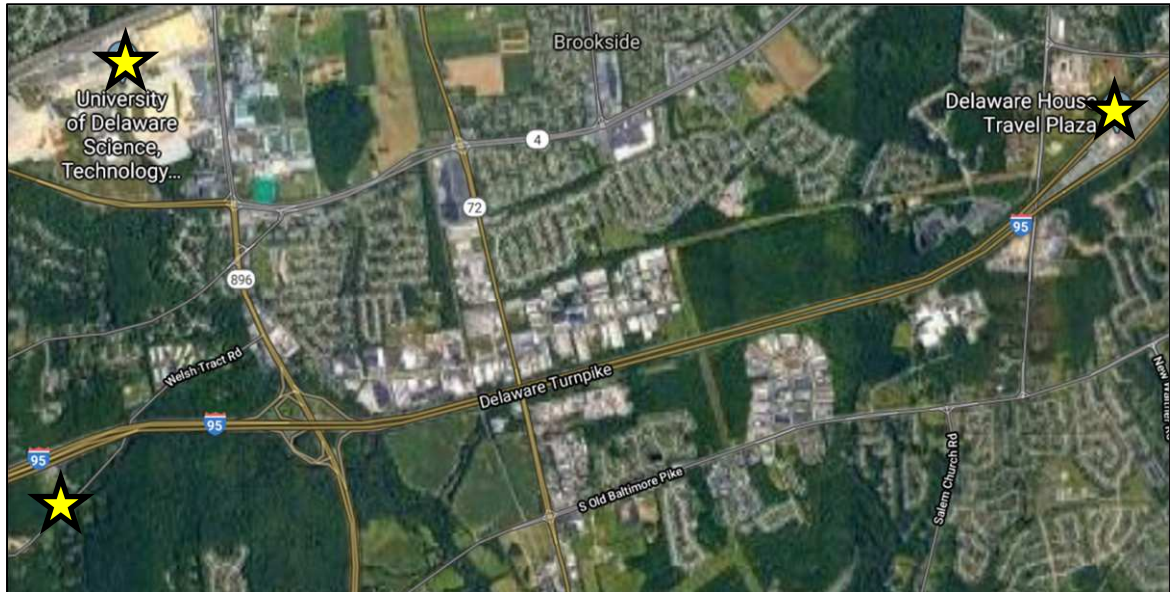
The VE Team recommends permanently implementing all-electronic tolling at I-95 Newark Toll Plaza. Converting the toll plaza to all-electronic tolling would likely improve of overall level of service through the Interchange and Toll Plaza by eliminating potential weave conflicts for traffic entering I-95 and attempting to access the EZ-pass only lanes. While there are challenges associated with implementing all-electronic tolling, including reassignment of existing toll collectors and obtaining stakeholder and public buy-in, this project could potentially provide additional benefit gains necessary to justify the move to all-electronic tolling.

3. Improve Constructability

- Increase off-site laydowns at select locations

Recommendation

The VE Team discussed a potential laydown area near the Welcome Center east of the project site. There is also potential space at the University of Delaware Star Campus on Discovery Boulevard located adjacent to the University of Delaware Science, Technology and Advanced Research Campus. Finally, the VE team discussed potential laydown area behind the Delaware E-Z Pass Service Center. Figure 17 shows the location of these potential laydown areas in relation to the I-95 and SR 896 Interchange. These sites are in close proximity to the project and would be beneficial especially if the maintenance of traffic for I-95 is such that limited lay down areas within the project limits are available.

Figure 17: Potential Laydown Areas


- Consider alternate project delivery and/or other schedule contractual mechanisms

Recommendation

It was apparent that the project delivery method has not yet been established and that the project delivery decision matrix process will occur after the Study is complete. Based on discussions during the Study, alternative project delivery strategies such as CM/GC and Design-Build may be considered for implementing the Project. One of the primary benefits to these alternative delivery methods is the input in the design process from the Contractor, which in this case could improve constructability. Discussions suggested that the Project may be a strong candidate for the CM/GC delivery method, but an evaluation needs to be completed. The VE Team noted the importance of defining the agency schedule, cost and performance goals, conducting a risk assessment and register, and completing a project delivery evaluation in order to make a thorough determination.

Schedule contractual mechanisms may also be considered. These options may work in conjunction with either an alternate delivery method or the traditional design-build-build method. Lane rentals would charge a fee to the contractor for closing lanes and shoulders during construction. The objective is to minimize impacts to I-95. This recommendation also provides the contractor additional

flexibility to secure short term areas as needed to best utilize the available work zone. Additionally, the team discussed other contractual mechanisms that could be used, like incentives/disincentives and A+B bidding, which should be considered to reduce the project duration and customer impacts.

- Consider technical recommendations regarding bridges

Recommendation

The VE Team provided the following technical recommendations related to the bridge design and construction plans for consideration of the Design Team.

During the information session presentation, the Design Team provided a plan sheet detail of Ramps A and C over the Christina River, part of Bridge 1-704A. The curvature of this structure may drive contractors to argue for line girder analysis during work drawing submittals. The VE Team recommends that any specific DelDOT requirements concerning the curved girders are clear in the bid documents, as curved girder analysis may be appropriate but more time consuming and costly for the contractor.

During the information session presentation, the Design Team provided plan sheet details as well as a discussion on constructability and erection of Bridge 1-703B. The VE Team took note of the length of this multi-span continuous bridge. Depending on the schedule requirements in the Contract, the Contractor may seek to start pouring before continuity is fully established across the structure. With the anticipated shoring towers, this may lock in unplanned deflections and stresses if establishing continuity does not occur before applying the dead load. The VE Team recommends that the Design Team consider requiring tightening of all splices fully prior to commencing dead load application to the superstructure (i.e. pans, deck pours, etc.).

During the information session presentation, the VE Team noted the need for shoring towers and curved girders, specifically for Bridge 1-703B. The VE Team would like the Design Team to ensure that the LRFD Reference Manual requirements for loading design, such as temporary work loads and wind loads, are clear in the bid documents.

4. Preserve Existing System

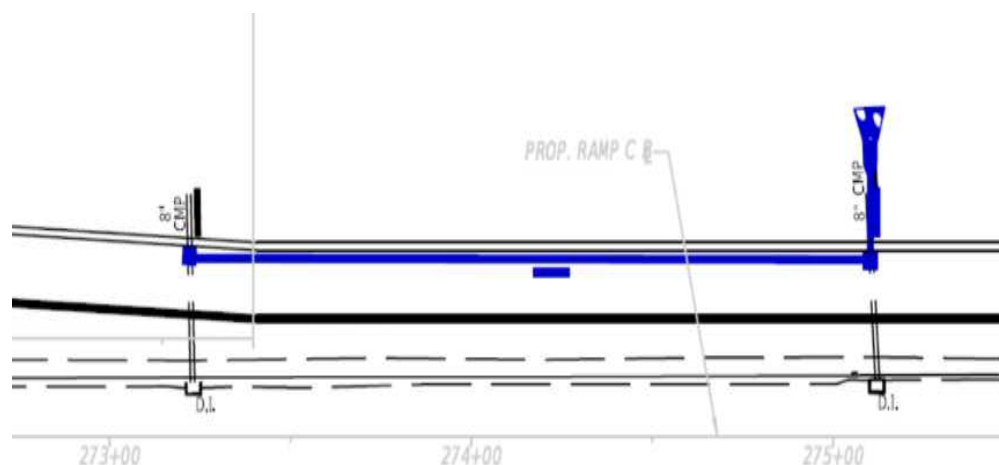
- Confirm existing conditions for utilities, drainage, and subsurface conditions

Recommendation

The VE Team recommends that the Design Team consider identifying clear utility corridors for required utility relocations and commencing advanced relocations as early as possible to prevent delays and disruptions during construction. Additionally, the VE Team noted the Utility Display Plan includes a number of existing utility crossings including fiber and communication crossings, but during the information session presentation, there were no potential fiber optic line relocations discussed. The VE Team would like to confirm with the Design Team whether additional fiber or communication utility relocations are required.

The VE Team noted that the existing CMP piping is being utilized in the proposed design at Ramp C (See Figure 18 below). The VE Team recommends that the Design Team confirm the proper conditions are met to use the existing piping and consider including maintenance tasks such as pipe lining in the bid to enhance the lifespan of the pipe and reduce the risk of delays during construction due to deteriorated condition on the existing pipe.

Figure 18: Proposed CMP Piping at Ramp C



Lastly, there are several items noted by the VE Team that can be resolved by additional geotechnical information. Additional information could provide clarity in the procurement documents, including for temporary works. The VE Team would like to confirm if ground improvements will be necessary, what sheeting and shoring can be used, and what subsurface rock elevations could limit the contractor.

- Evaluate LMC versus PPC Overlay for existing bridges

Recommendation

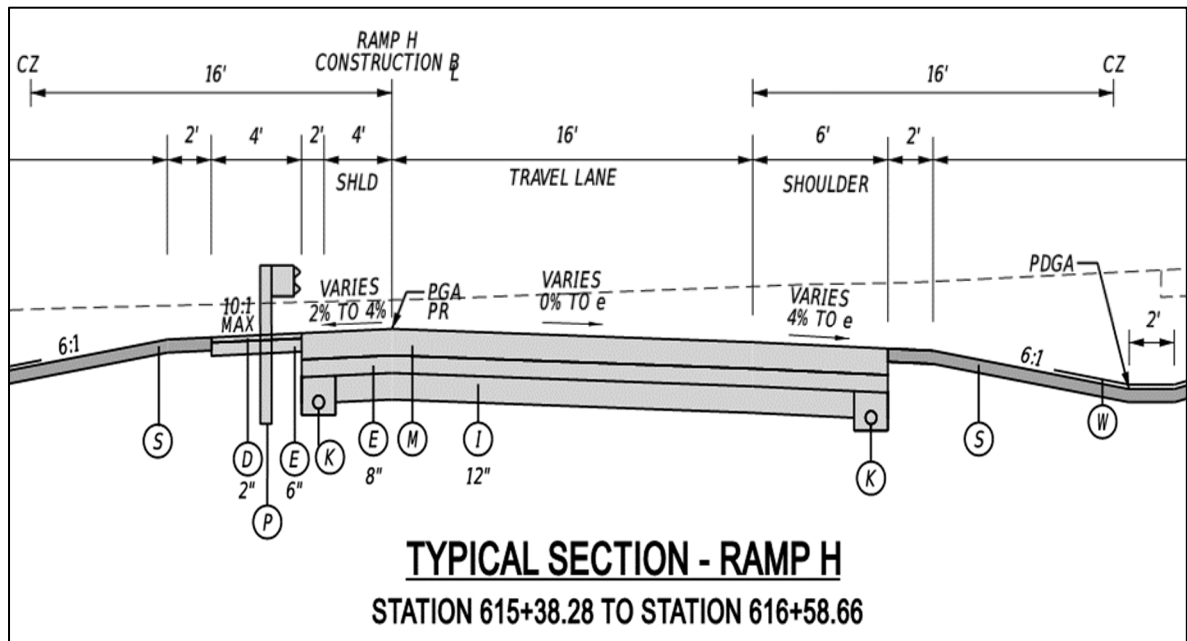
The VE Team recognized the well-established high quality of LMC overlays but expressed concerns with the duration needed for installation and the temperature sensitivity of the product. The Design Team noted that it is intended that other products will be further evaluated and coordinated with the overall I-95 construction sequencing. The VE Team concurred that this approach was appropriate and indicated that PPC overlays may provide a faster application in this case.

5. Manage Drainage

- Reduce underdrain at select ramps

Recommendation

The VE Team noted that underdrain is called for on both sides at Ramp C, Ramp F&G and Ramp H. The Team noted that certain runs of underdrain will not provide much benefit including the underdrain on the high side of the cross slope for Ramp C and the underdrain on the 4-foot shoulders at Ramp F&G and Ramp H (See Figure 19). It is recommended that underdrains with minimal capture potential be reviewed for possible elimination.

Figure 19: Underdrain at Ramp H

6. Complete on Budget

- Review need for reinforced concrete pipe end section Item

Recommendation

The VE Team noticed that there was no line item for a reinforced concrete flared end section for the 24-inch piping, despite the inclusion of the 24-inch reinforced concrete piping (Item 601035). The Design Team should review the line item to ensure the flared end section is not needed.

- Add cost items to preliminary cost estimate

Recommendation

The following cost items listed below were presented by the VE Team as items that should be considered for inclusion in the Preliminary Cost Estimate.

Item 302002 – No. 3 Stone

The VE Team recommends the Design Team review the preliminary cost estimate for the stabilized construction entrance. No. 3 Stone is required for initial placement of Item 908023, Stabilized Construction

Entrance, under the April 2019 supplementals. Item 908024, Stabilized Construction Entrance, topdressing, is just the stone maintenance item. All three items are required to construct a stabilized construction entrance.

Item 602505 – Personal safety grate for pipes over 12-inch diameter

The VE Team recommends the Design Team review the preliminary cost estimate to ensure the necessary safety grates are included. Personal safety grate for pipes over 12 inches in diameter that do not see daylight is required per DGM 1-15.

Item 302005 – Stones for undercut areas

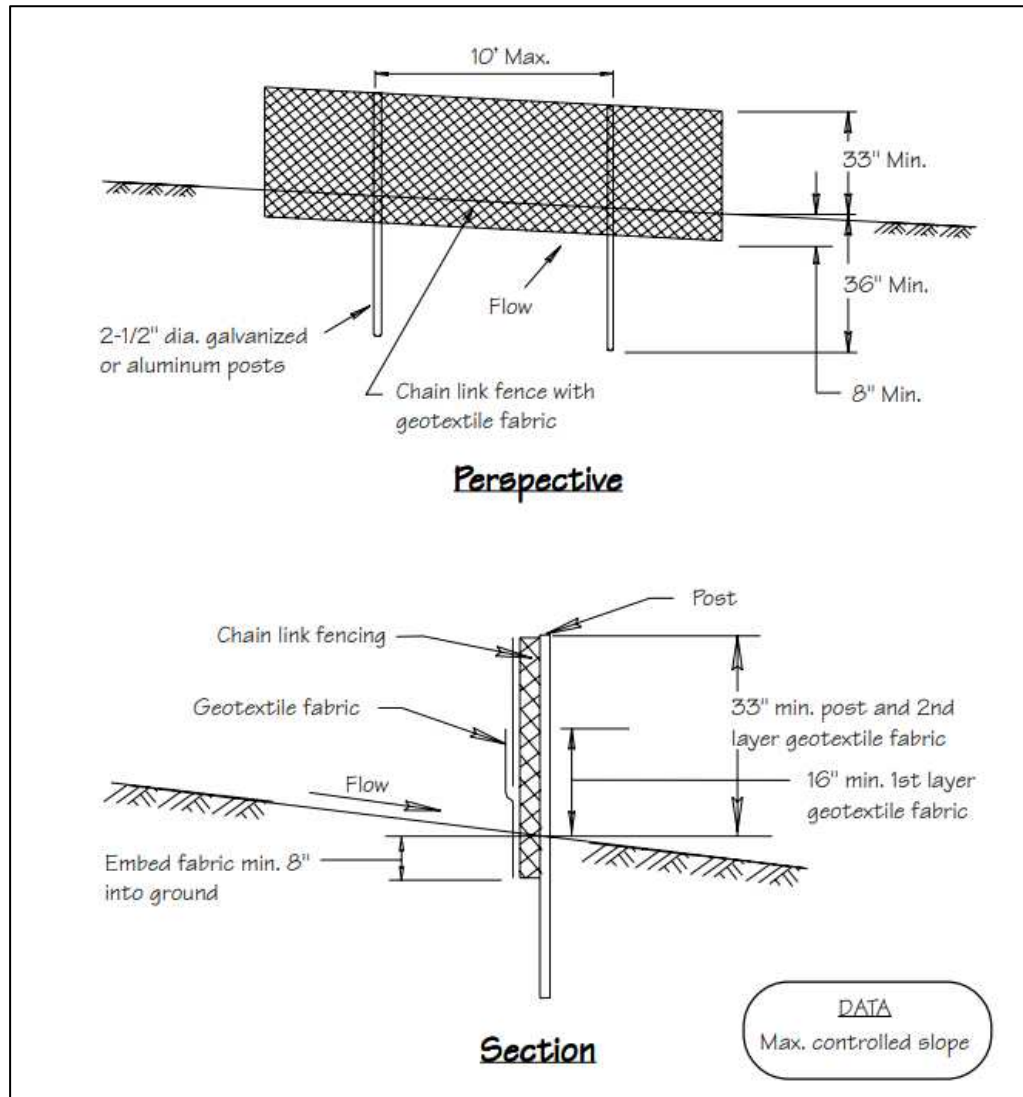
The VE Team recommends the Design Team review the preliminary cost estimate to ensure the undercuts areas are properly supported. The Team specifically recommends adding No. 57 stone as a cost item, per ton, for undercut areas.

Item 708003 – Geotextile, Riprap

The VE Team recommends the Design Team review the preliminary cost estimate and include Item 708003 - Geotextile, Riprap to go under Item 707001 - Riprap R-4.

Item 905500 – Super silt fence for bridge areas

The VE Team recommends the Design Team include in the preliminary cost estimate a line item for super silt fence (See Figure 20) around bridge areas or clarify the suggested line item is part of the lump sums in the bridge section.

Figure 20 – Super Silt Fence

- Clarify E&S Items in the preliminary cost estimate:

Recommendation

The following cost items listed below were included in the Preliminary Cost Estimate and highlighted by the VE Team. Please clarify if there are separate items or these items are included in the lump sum bridge items.

- Item 909005 – Stream diversion
- Item 906003 – Sump pit
- Item 906002 – Dewatering bags (See Figure 21)

Figure 21: Dewatering Bag

- Clarify railroad services in budget

Recommendation

It is currently unclear whether or not the Preliminary Cost Estimate includes railroad services such as flaggers during construction. The VE Team would like clarification on these services and how they fit into the cost estimate. It was also suggested that a construction and access agreement with Norfolk Southern be obtained as soon as possible. A sample agreement was provided by the VE Team.

- Consider contingent Item for pile abandonment

Recommendation

The VE Team recommends adding a contingent Item for pile abandonment at h-pile foundation locations where boulders are anticipated to establish a clear process for addressing obstructions during driving operations.

7. Optimize Material Costs

- Review removal items

Recommendation

The VE Team recommends reviewing Item 834501, Partial Removal of Concrete Pole Bases and Cabinet Foundations, and Item 211000, Removal of Structures and Obstructions for potential redundancies. This recommendation is based on the conversation during the study that concluded it is typical to remove foundations to only a certain distance below finish grade.

- Use Alternative Materials in fill situations

Recommendation

The project will require a considerable amount of fill. Because the job will require borrow, the VE Team recommends alternatives such as use of asphalt millings for fill situations if possible. Currently the design calls for A, B and F borrow.

- Consider substitute to ultra-high performance concrete (UHPC)

Recommendation

Consider a substitute that may be acceptable in place of UHPC such as a tie-rod and grout. UHPC is proprietary and tends to be expensive. Limited availability may result in schedule coordination and delay issues. The Design Team noted that DelDOT has good experience with using UHPC, and so the VE Team acknowledged this may be a regional concern not experienced by Delaware.

IX. SUMMARY OF VE RECOMMENDATIONS AND IMPLEMENTATION PANEL DISCUSSIONS

The following table summarizes the priority items detailed above and their potential estimated value of savings as determined by the VE Team. It has been determined that the following priority items can be implemented in conjunction with one another and do not interfere with one another.

Summary of VE Priority Items and Implementation Panel Decisions				
VE Priority Items	Priority Designation	Justification	Estimated Value	Panel Decision
Reduce Shared Use Path Width to 10 Feet	High	Cost Savings	\$642,900	✗
Consider Alternatives to Adjust Phasing and MOT	High	Cost and Time Savings	\$10,000,000	✓
Modify Retaining Wall 9	High	Cost Savings, Potential Time Savings	\$700,000	✗
Consider Alternate Foundation at Bridge 1-706	High	Time Savings	\$0	Analyze
Minimize Pinned Barrier	High	Cost and Time Savings	\$758,000	✓
Consider Alternate Joint Detail to preserve Bridge Bearings	High	Cost Savings	\$1,200,000	✓
Consider open drainage on Shared Use Path	High	Cost Savings	\$74,250	Analyze
Remove Item 74342 – Temporary Smart Work Zone	High	Cost Savings	\$250,000	✗
Consider Alternate Drainage Detail across I-95	Medium	Cost Savings and Access	\$86,820	✗
Eliminate Ramp J Guardrail	Medium	Cost Savings	\$38,500	✗
Replace Wood Rail Fence with Chain Link Fence	Medium	Cost Savings	\$104,600	✓
Consider Temporary BMPs	Low	Access	\$0	Analyze

The total estimated cost savings of these priority items is \$13,855,070. In addition to the cost savings of the listed alternatives, there are a number of alternatives that will improve the efficiency of the project, improve construction and roadway safety, and extend the project's life cycle, all of which serve to better meet the project's purpose and need.

In addition to the Value Engineering alternatives, the VE Team provided the following team recommendations for consideration by the Design Team.

Summary of VE Items and Implementation Panel Decisions		
VE Recommendation		Panel Decision
1.	Provide Multi-modal Access	
2.	Improve Level of Service	
	Coordinate construction of SR 896 widening south of Interchange	✓
	Evaluate all-electronic tolling for permanent condition	✗
3.	Improve Constructability	
	Review potential offsite laydown areas at Welcome Center, Toll Plaza, and Star Campus	✓
	Consider alternate project delivery and/or other schedule contractual mechanisms	✓
	Consider technical recommendations regarding bridges	✓
4.	Preserve Existing System	
	Confirm existing conditions for utilities, drainage, and subsurface conditions	Analyze
	Evaluate LMC versus PPC overlay for existing bridges	Analyze
5.	Manage Drainage	
	Reduce underdrain at select ramps	✓
6.	Complete on Budget	
	Review Need for RCP Flared End Section Item	✓
	Add Cost Item 302002 – No. 3 Stone	✓
	Add Cost Item 302005 – No. 57 Stone	✓
	Add Cost Item 602505 – Personal safety grate for pipes over 12-inch diameter	✓

Summary of VE Items and Implementation Panel Decisions		
VE Recommendation		Panel Decision
	Add Cost Item 708003 – Geotextiles, Riprap	✓
	Add Cost Item 905500 – Super Silt Fence at bridge areas	✓
	Clarify if Item 909005 – Stream diversion will be separate (added) or included in Structure Lump Sum	✓
	Clarify if Item 906003 – Sump pit will be separate (added) or included in Structure Lump Sum	✓
	Clarify if Item 906002 – Dewatering bags will be separate (added) or included in Structure Lump Sum	✓
	Confirm railroad services cost and construction agreement in advance	✓
	Consider contingent Item for pile abandonment	✓
7.	Optimize Material Cost	
	Review Item 834501, Partial Removal of Concrete Pole Bases & Cabinet Foundations, and Item 211000, Removal of Structures and Obstructions for redundancies	✓
	Consider use of alternative materials for fill to reduce required borrow	✓
	Consider substitutes to ultra-high performance concrete if material availability is an issue	✗

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APPENDIX A
March 16, 2020 Information Session Agenda

Value Engineering Info Session Agenda

I-95 and SR 896

Contract T201609002



March 16, 2020 (9:00 a.m. – 12:00 p.m.)

9:00 – 9:10 Why We're All Here

- Value Engineering is a federal requirement on every National Highway System project that exceeds \$50M, and each bridge project that exceeds \$40M (Federal Regulations 23 CFR Part 627)
- Value Engineering Study Team is responsible for five of the eight phases in the VE job plan (investigation, function analysis, creative, evaluation, development)
- Our objectives (DelDOT P.I. D-05):
 - Maintain the project's function
 - Minimize the life-cycle cost of a project
 - Highlight potential cost reductions while maintaining function
 - Review previous decisions to determine if they are still valid
 - Produce a better transportation product

9:10 – 9:20 Introduce Participants

- Value Engineering Study Team
- Design Team

9:20 – 12:00 Design Team Presentations/ VE Team Questions

Notes:

- Preparation between the two sessions will provide a better final product. Please review the cost estimates and consider what sort of savings your initial ideas can attain.
- The design team is here to both present and to answer questions. Feel free to request any additional information that will help us reach our objective for the study on April 1 and April 2, 2020.
- When you are preparing for the study consider the costs of your improvements, and how the improvements can be combined. This will make our study session discussion much more productive.

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APPENDIX B
April 27-18, 2020 Study Agenda

Value Engineering Study Session Agenda
I-95 and SR 896
Contract T201609002
April 27, 2020 - April 28, 2020



April 27, 2020

9:00 am – 11:00 am

- Welcome and Introductions
- Review of Ground Rules
- Review of Value Engineering Background and Process
- Value Engineering – Information
 - Project History
 - Design Team Information Recap

1:00 pm – 3:00 pm

- Brief sound/video check and ground rule review
- Summarize morning session
- Value Engineering - Function Analysis
 - Identify project functions
 - Categorize functions
 - Analyze functions
 - Improve, eliminate, combine
- Value Engineering - Creative
 - Brainstorming for identified functions and alternatives
 - Generate alternative ideas for project functions

April 28, 2020

10:30 am – 12:30 am

- Brief sound/video check and ground rule review
- Summarize Day 1 progress
- Value Engineering - Evaluation
 - Refine/combine ideas
 - Develop functional alternatives
 - Evaluate by comparison
 - Use Risk Analysis, Adjectival Criteria, Weighted Criteria, Advantage/Disadvantage

1:30 pm – 3:30 pm

- Brief sound/video check and ground rule review
- Summarize morning session
- Value Engineering - Development
 - Detail alternatives
 - List alternatives with greatest potential
 - Determine costs
 - Provide supporting documentation for each alternative

If necessary, the study will continue on May 6, 2020



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APPENDIX C
Value Engineering Function Analysis Worksheet

Appendix C - Value Engineering Function Spreadsheet					
Function	Verb	Noun	Time Savings	Cost Savings	Priority
Provide Shared Use Path					
Reduce path width from 12 feet to 10 feet	Reduce	Lane Width	-	\$ 6,429,000	High
Remove bike path from Ramp D to Route 72 Corridor	Eliminate	Bike Trail	Eliminated		
Improve Level of Service					
Utilize diamond configuration on SR 896 to eliminate unsignalized left hand turn movement	Utilize	DDI on SR896	Eliminated		
Coordinate construction of SR 896 third lane	Add	Third Lane/ Bike Path to SR896	-	-	Team Rec
Evaluate permanent electronic tolling	Evaluate	Electronic Tolling	-	-	Team Rec
Improve Constructability					
Consider alternatives for phasing and mainenance of traffic*	Utilize	Flexible MOT	Up to One Year	\$ 10,000,000	High
Eliminate/modify Retaining Wall No. 9	Eliminate	Retaining Wall	Minor Savings	\$ 7,000,000	High
Consider foundation alternatives at railroad bridge	Utilize	Foundation Alternatives	-	\$ -	High
Minimize pinned barriers	Minimize	Pinned Barriers	Minor Savings	\$ 758,000	High
Consider potential laydown areas at Welcome Center, Toll Plaza, and Star Campus	Increase	Off-site Laydowns	-	-	Team Rec
Consider contractor lane rental	Utilize	Lane Rental	-	-	Team Rec
Consider technical recommendations regarding bridges	Utilize	Bridge Recommendations	-	-	Team Rec
Preserve Existing System					
Consider alternate joint detail to move joint off bridge and preserve bearings	Maximize	Bridge Life Cycle	Extended Life Cycle	\$ 1,200,000	High

Appendix C - Value Engineering Function Spreadsheet					
Function	Verb	Noun	Time Savings	Cost Savings	Priority
Confirm existing conditions for utilities, drainage, and subsurface conditions	Confirm	Existing Conditions	-	-	Team Rec
Manage Drainage					
Consider smaller temporary BMP	Utilize	Temporary BMP	-	\$ -	Low
Consider alternate drainage crossing at I-95	Utilize	Drainage Alternatives	Minor Savings	\$ 200,000	Medium
Use open drainage where possible	Use	Open Drainage	-	\$ 74,250	High
Reduce underdrain at select ramps	Reduce	Underdrain	-	-	Team Rec
Complete On Budget					
Remove Item 743542 – Temporary Smart Work Zone	Remove	Temporary Smart Work Zone	-	\$ 250,000	High
Eliminate Ramp J guardrail	Eliminate	Ramp J Guardrail	Minor Savings	\$ 38,500	Medium
Review need to add Item for RCP flare end section	Review	RCP Requirements	-	-	Team Rec
Add cost items for stone/ geotextile	Add	Cost Items	-	Added costs	Team Rec
Clarify E&S Items for stream diversion/ sump pit/ dewatering	Clarify	E&S Items	-	-	Team Rec
Confirm railroad services cost and construction agreement in advance	Confirm	Railroad Services	-	-	Team Rec
Consider contingent Item for pile abandonment	Add	Contingency for pile abandonment	-	-	Team Rec
Optimize Material Costs					
Replace wood rail fence with chain link fence	Utilize	Chain Link Fence	-	Life cycle savings	Medium
Review for redundancy between Item 834501 and Item 211000	Review	Potential Redundancies	-	Potential Savings	Team Rec
Use HMA millings in fill situations	Use	HMA Millings in Fill Situations	Potential Savings	Potential Savings	Team Rec
Consider substitutes to ultra-high performance concrete (UHPC)	Use	UHPC Alternative	-	Potential Savings	Team Rec

* Refer to Appendix D for expanded summary of alternatives for Phasing/MOT

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APPENDIX D
Project Phasing References

Function	Verb	Noun	Comments	Advantages	Disadvantages
Consider Alternative Phasing and MOT Schemes to Maximize Work Area	Evaluate	All Electronic Tolling	Consider using all electronic tolling on I-95 during construction	Easier MOT through the work zone and open up possibility for larger work zone areas. Time savings.	Requires approval and buy-in.
	Utilize	Early Action Ramp A	Adjust phasing to construct temporary ramp A first. Break out and standalone. When finished put traffic on Ramp A, could then build Ramp C. Could close ramps F and G earlier. Ramp C as soon as possible to give more access for constructing Ramp D and NB I-95 widening.	Helps with staging of bridges 705 and 706 due to less traffic volume, open up project for other phasing considerations.	Duration between temporary ramp and start of this phase could mean an extended work zone period of a temporary structure (slower speed limit).
	Detour	Ramps F and G early	Biggest ramps are C and D. They are currently open in Phase 4 and Phase 5. If they can be completed earlier, they would free up congestion points earlier and potentially allow more access options.	The biggest point of this discussion is the ability to give the contractor more flexibility and less excuses for issues on site. This opens up options for delivery options, such as A+B, which will reduce construction time.	Will need one additional phase to complete ramp C.
	Advance	I-649B and I-704A	Consider adding these to Phase 1.	More time and flexibility considering in stream restrictions.	This reduction in phasing could make the bid less competitive.
	Advance	Existing Bridges	Move the (704-709) bridge work into an earlier phase currently shown in phase 5. Coordinate bridge work with overlay sections to manage weave conditions and service plaza access. I-95 roadway work could be worked concurrently with bridge work/other work – consider extensions of Ramp	Saving at least one construction season. The savings will be in the contractor overhead.	MOT scheme for this work in conjunction with interchange work requires consideration for coordination of access for Welcome Center, Interchange and Tolls.

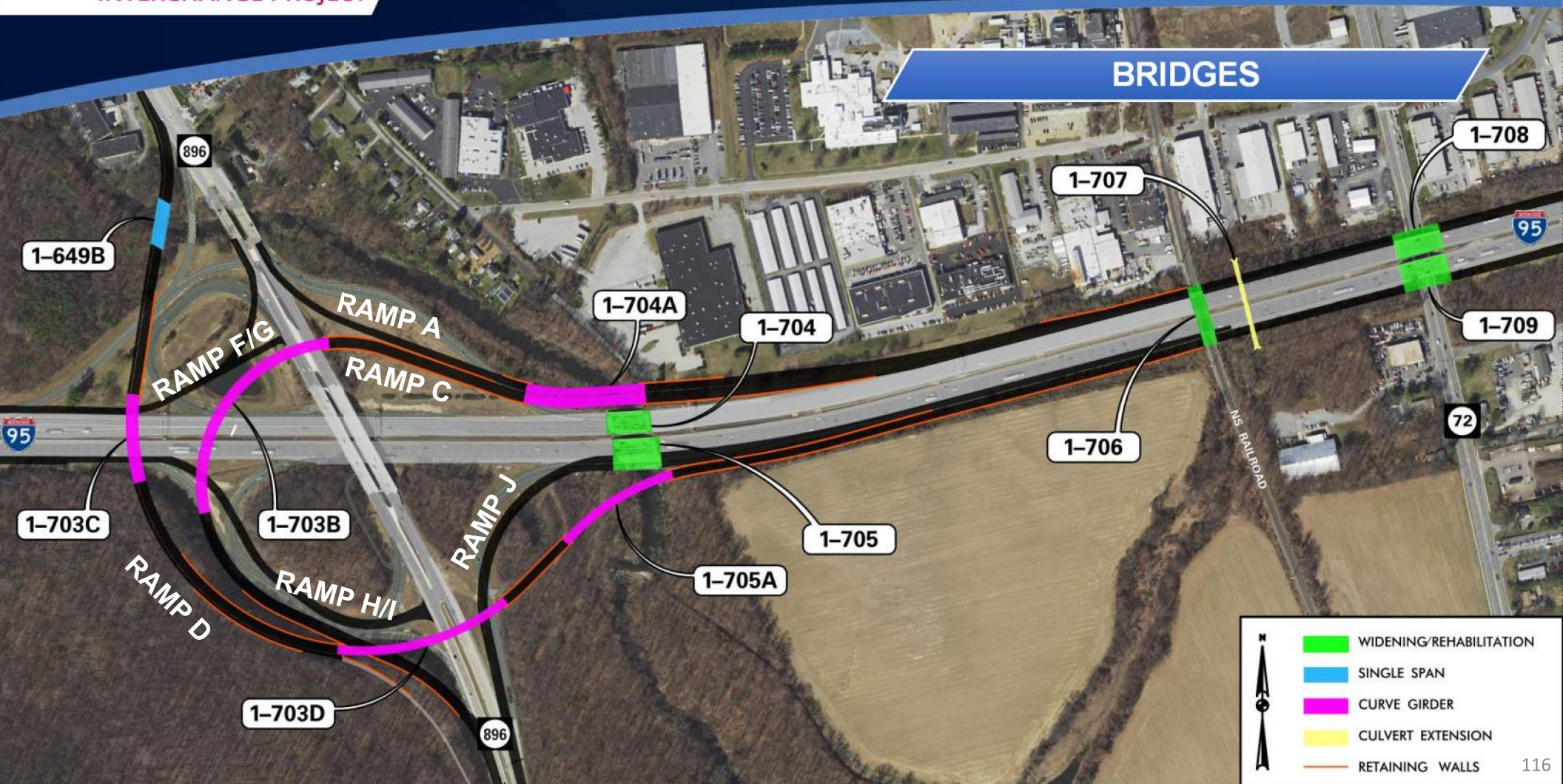
Function	Verb	Noun	Comments	Advantages	Disadvantages
			C and D on I-95 east of SR 896 (in addition to bridge work mentioned above).		
	Reduce	I-95 Lanes	Reduce temporary lanes from 4 to 3 or reduce lane widths on I-95 NB and SB.	Decrease the project footprint and increase the laydown/ deliveries/ work area for contractor.	May not provide adequate capacity for traffic.
	Increase	On-site Laydown	Use one lane of SR 896 during construction in order to utilize additional space for staging and laydowns. There are existing plans for this alternative.	Better delivery coordination. Provides additional room for contractor, increases safety. Time savings.	Traffic will go into contraflow. Adds staging. Closing SB 896 could cause issues with traffic flow.
	Concurrent	Widening	Widening in Phases 1 and 2 could progress concurrently rather than sequentially with an interim stage milestone for the opening of Ramp A.	Time Savings, Enable earlier access to Bridge I-706 over Norfolk Southern.	
	Maximize	Lane Hours	Consider a scheme to allow adequate time for girder setting and potential coordination of drainage crossing for overnight detours.	Addresses issue for phasing of crossing install.	Short term closure may not provide adequate shift to excavate, install and backfill.
	Use	Precast Forms	Use precast “bathtub” form to avoid coffer dams. Bottom of footing will have higher elevation.	Could reduce costs and simplify construction at bridge 705A.	

I-95 & SR 896 INTERCHANGE PROJECT

Value Engineering Informational Meeting



BRIDGES



I-95 & SR 896 INTERCHANGE PROJECT

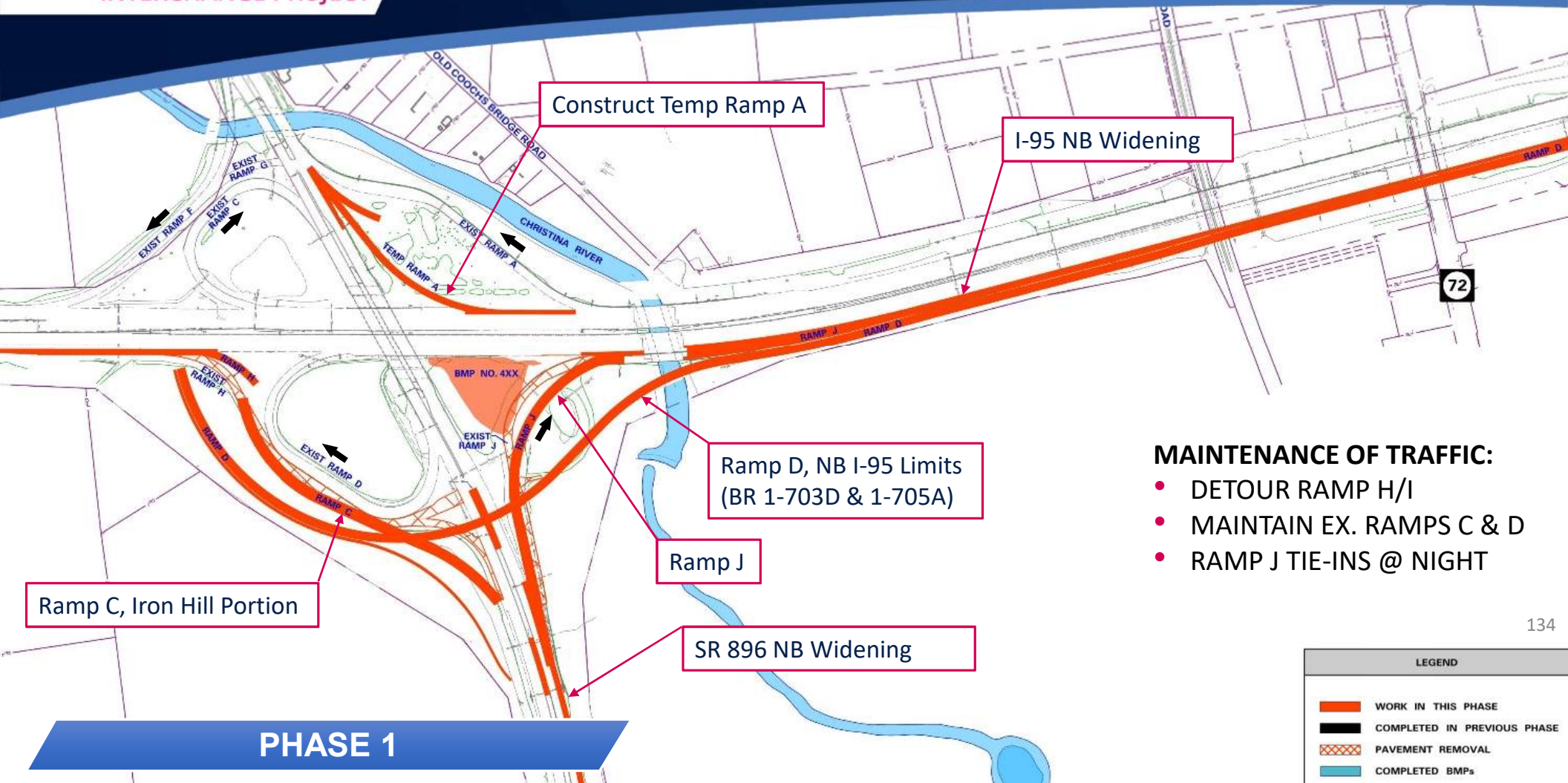
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LEGEND	
—	WORK IN THIS PHASE
—	COMPLETED IN PREVIOUS PHASE
 	PAVEMENT REMOVAL
—	COMPLETED BMPs

I-95 & SR 896 INTERCHANGE PROJECT

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MAINTENANCE OF TRAFFIC:

- DETOUR RAMP H/I
- MAINTAIN EX. RAMPS C & D
- RAMP J TIE-INS @ NIGHT

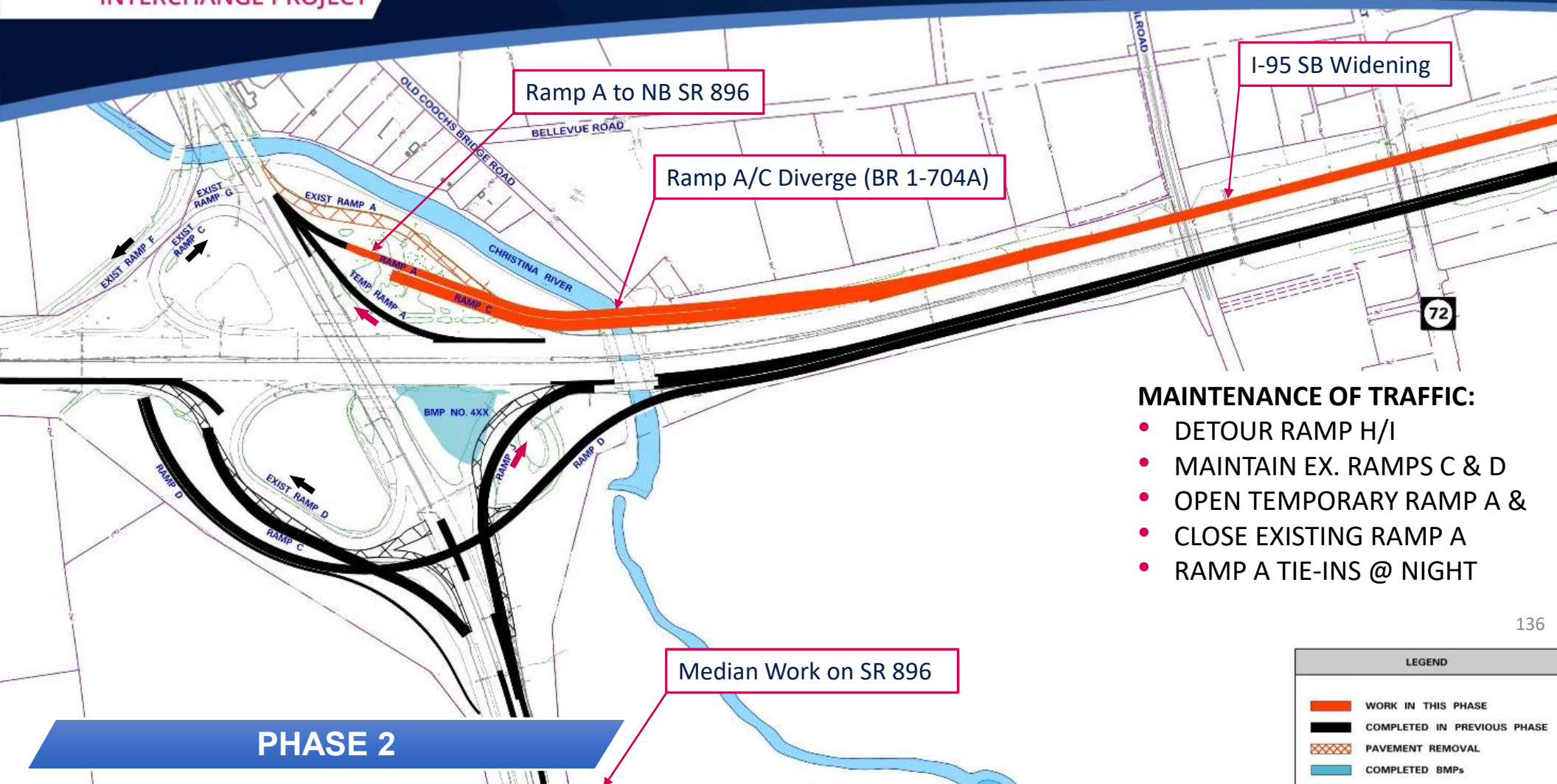
I-95 & SR 896 INTERCHANGE PROJECT

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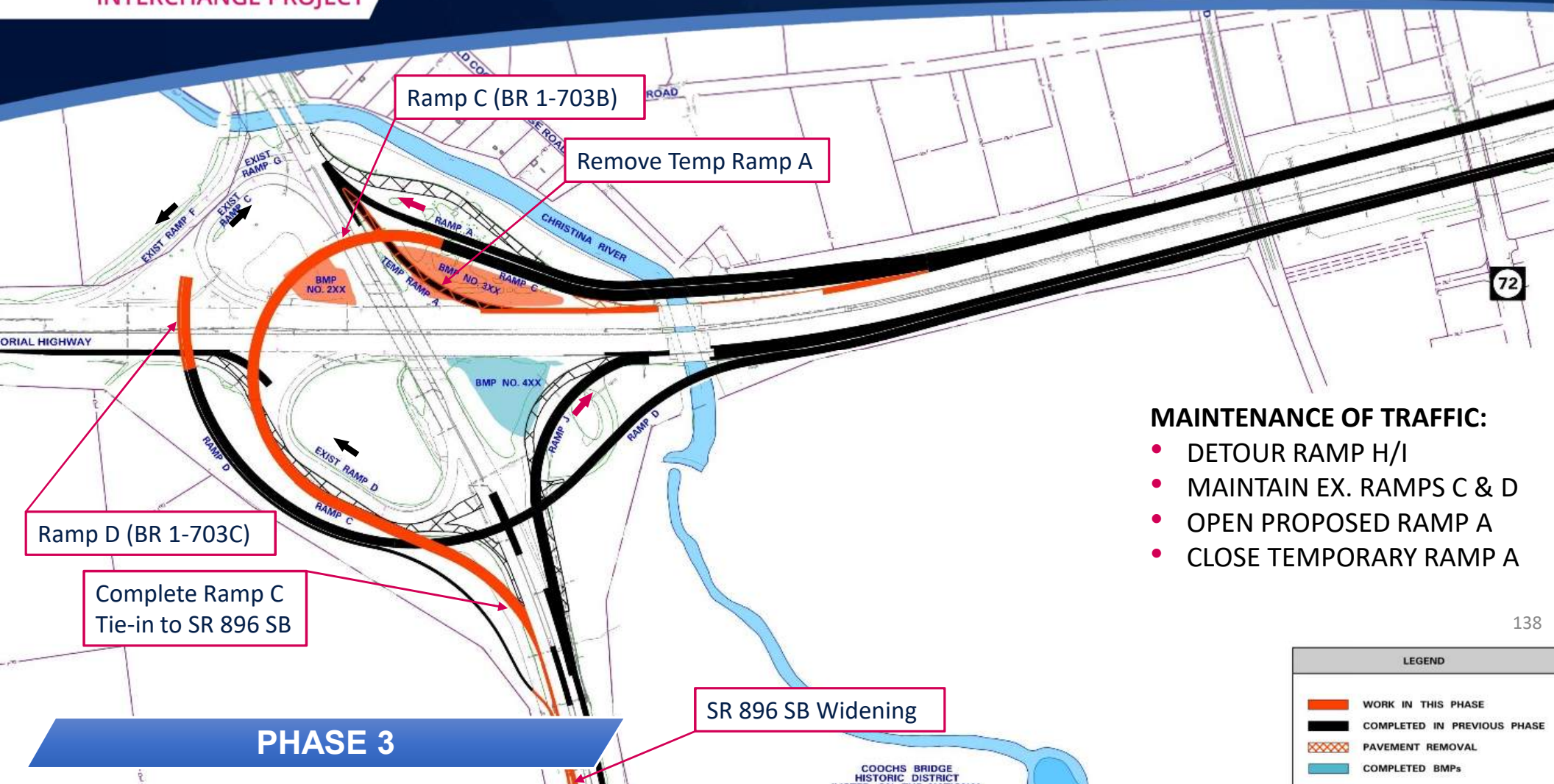


LEGEND

- WORK IN THIS PHASE
- COMPLETED IN PREVIOUS PHASE
- PAVEMENT REMOVAL
- COMPLETED BMPs

I-95 & SR 896 INTERCHANGE PROJECT

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MAINTENANCE OF TRAFFIC:

- DETOUR RAMP H/I
- MAINTAIN EX. RAMPS C & D
- OPEN PROPOSED RAMP A
- CLOSE TEMPORARY RAMP A

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LEGEND	
	WORK IN THIS PHASE
	COMPLETED IN PREVIOUS PHASE
	PAVEMENT REMOVAL
	COMPLETED BMPs

I-95 & SR 896 INTERCHANGE PROJECT

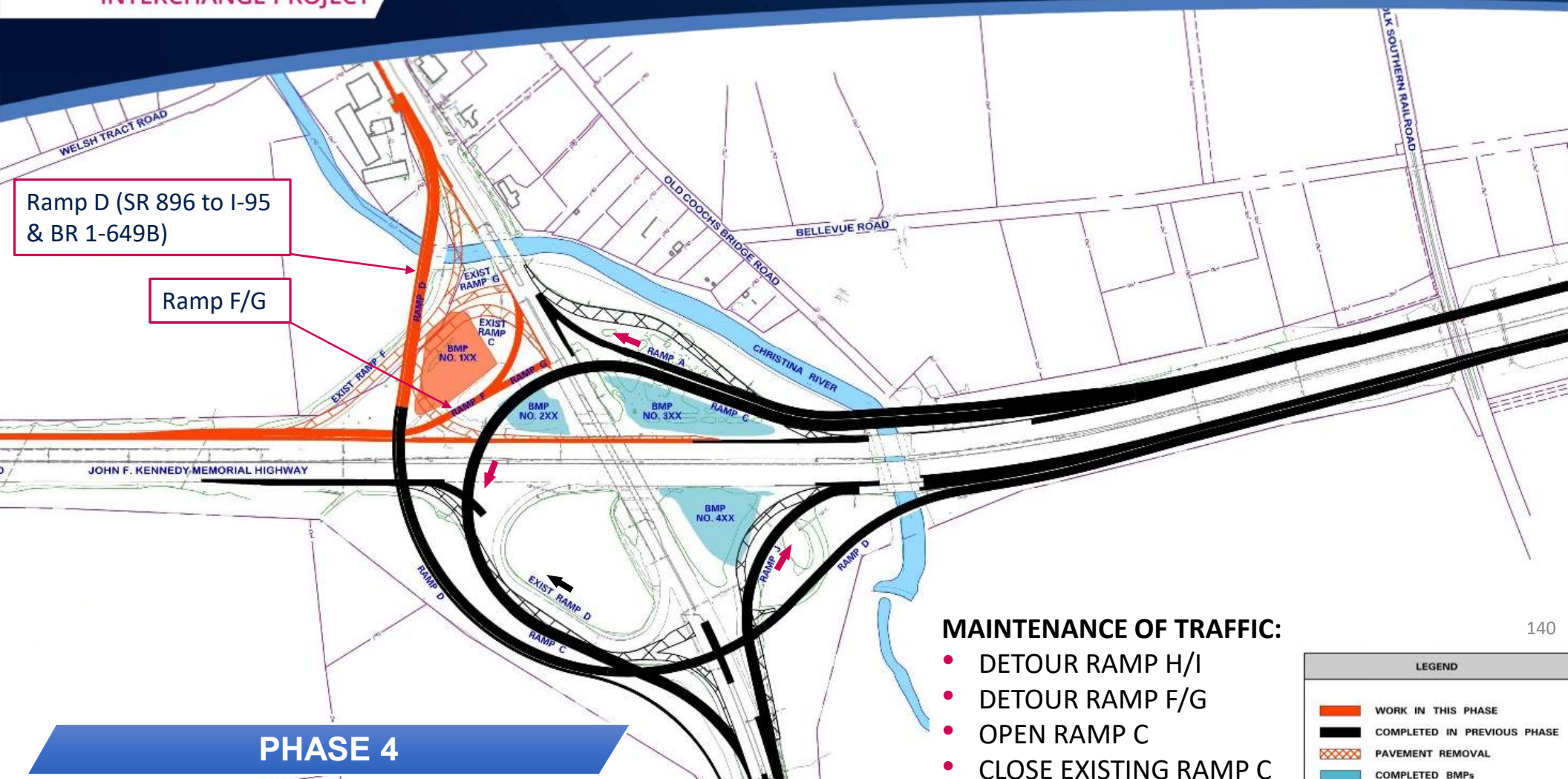
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PHASE 4

I-95 & SR 896 INTERCHANGE PROJECT

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PHASE 4

I-95 & SR 896 INTERCHANGE PROJECT

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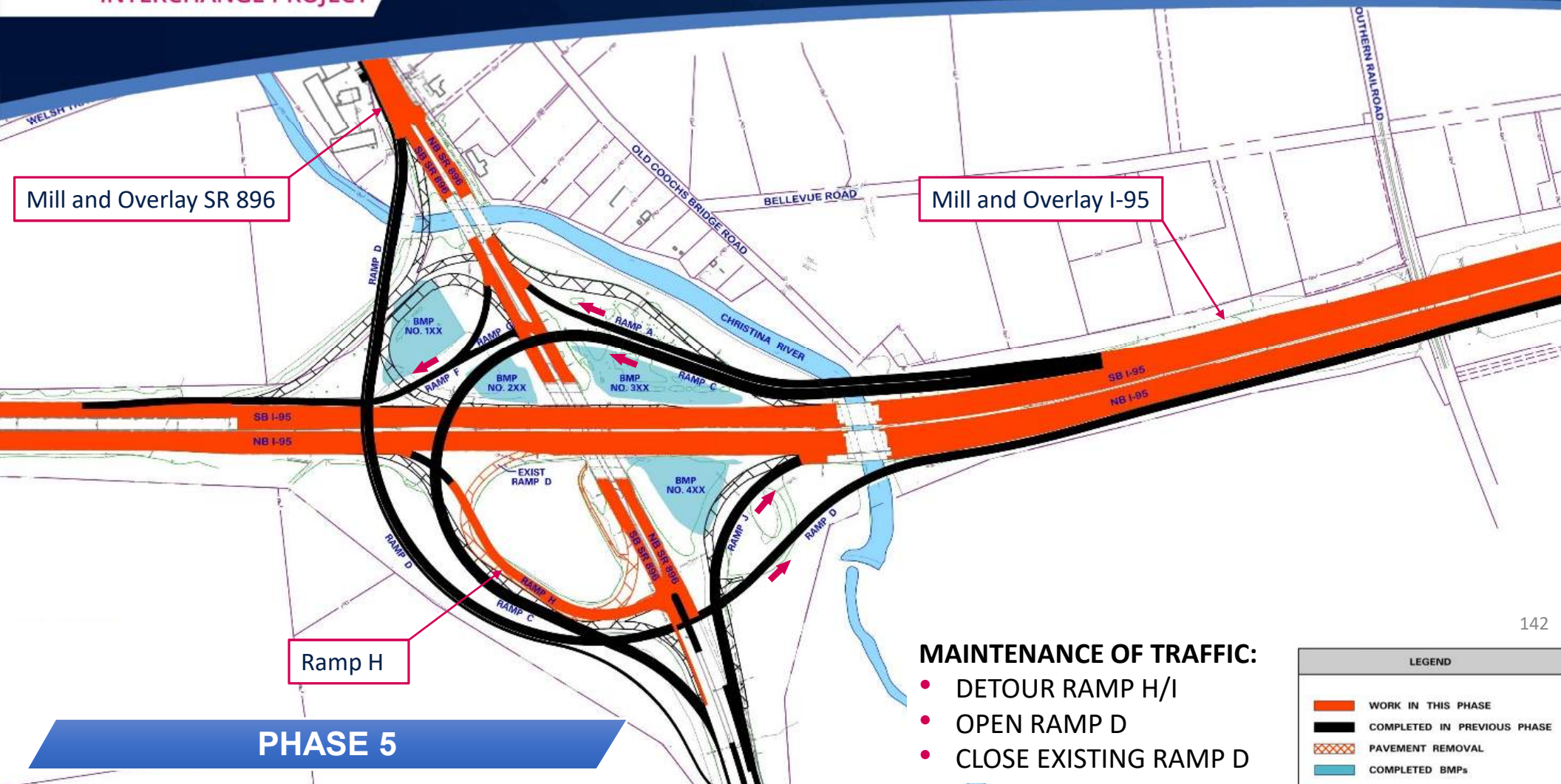
PHASE 5

LEGEND

- WORK IN THIS PHASE
- COMPLETED IN PREVIOUS PHASE
- PAVEMENT REMOVAL
- COMPLETED BMPs

I-95 & SR 896 INTERCHANGE PROJECT

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MAINTENANCE OF TRAFFIC:

- DETOUR RAMP H/I
- OPEN RAMP D
- CLOSE EXISTING RAMP D

LEGEND

- WORK IN THIS PHASE
- COMPLETED IN PREVIOUS PHASE
- PAVEMENT REMOVAL
- COMPLETED BMPs

FINAL

APPENDIX E
June 25, 2020 VE Implementation Meeting Minutes

DATE: June 30, 2020

MEETING DATE: June 25, 2020

IN ATTENDANCE:

Shante Hastings	DelDOT
John Sisson	DelDOT
Lanie Thornton	DelDOT
Marc Cote	DelDOT
Anne Brown	DelDOT
Mark Luszcz	DelDOT
John Caruano	DelDOT
Jim Pappas	DelDOT
Breanna Kovach	DelDOT
Brad Damtoft	DelDOT
Pam Steinebach	DelDOT
Maureen Kelley	DelDOT
Laura Anderson	Century
Steven Penozza	Century
Bill Conway	Century
Kate Smagala	Century
Matt Allen	Wallace Montgomery
Jaime Vargas	Wallace Montgomery

SUBJECT: I-95 & SR 896 Interchange
Value Engineering Recommendations

PREPARED BY: Steven Penozza

DISCUSSION:

The meeting was held to discuss the recommendations presented in the Value Engineering report and which recommendations would be implemented. See the attached matrix for recommendations and summary of decisions.

VE Priority Items

1. Reduce path width from 12 ft to 10 ft – Implementation Committee agrees with the Project Team to leave SUP width at 12 ft per AASHTO Standards.
2. Alternatives for Construction Phasing and MOT – Implementation Committee agrees with the Project Team to evaluate and implement phasing and MOT feasible concepts.

3. Eliminate section of Retaining Wall No. 9 (1000 ft) – Implementation Committee agrees with Project Team to leave section of retaining wall in place and not impact the environmentally sensitive Cooch property.
4. Micropiles on Bridge 1-706 – Implementation Committee agrees with project team to analyze the use of micropiles on Bridge 1-706 to determine if the change in foundation type is a better alternative. Final recommendation will be coordinated with DelDOT Bridge Design.
5. Minimize Pinned Barrier – Implementation Committee agrees with Project Team to minimize pinned barrier on the project. The Project Team will evaluate potential work zones as construction phasing is progressed.
6. Alternative Bridge Joint Detail – Implementation Committee agrees with use of the alternative joint detail. This will be further coordinated with DelDOT Maintenance during the design process.
7. Smaller Temporary BMP – Implementation Committee agrees with the Project Team to analyze the use of smaller temporary BMPs as laydown areas are investigated for the contractor.
8. Alternative pipe crossing SB I-95 – Implementation Committee agrees with the Project Team to leave the proposed pipe in place if required by the design.
9. Open Drainage adjacent to SUP – Implementation Committee recommends open drainage adjacent to the SUP if possible. The Project Team will analyze the removal of the closed drainage system.
10. Alternative Temporary Smart Work Zone – Implementation Committee agrees with the Project Team to keep the Smart Work Zone.
11. Eliminate Ramp J Guardrail – Implementation Committee agrees with the Project Team to keep guardrail in place.
12. Replace Wood Fence with Chain Link – Implementation Committee agrees with Project Team to replace wood fence with a black chain link fence.

VE Plan Recommendations

Implementation Committee Agrees with the Project Team to implement the following Plan Recommendations:

- Coordinate construction of SR 896 widening south of interchange
- Consider potential offsite laydown areas at Welcome Center, Toll Plaza, and Star Campus
- Consider alternative project delivery (CM/GC) and/or other contractual mechanisms

- Consider technical recommendations regarding bridges
- Reduce underdrain at select ramps
- Review need for reinforced concrete pipe end section items
- Add cost items to Preliminary Cost Estimate
- Clarify E&S Items in Preliminary Cost Estimate
- Clarify railroad services cost and construction agreement in advance
- Consider contingent item for pile abandonment
- Review redundancy in removal items
- Use alternative materials in fill situations

Implementation Committee Agrees with the Project Team to ANALYZE the following Plan Recommendations:

- Confirm existing conditions for utilities, drainage and subsurface conditions
- Evaluate LMC vs PPC overlay for existing bridges

Implementation Committee Agrees with the Project Team to NOT implement the following Plan Recommendations:

- Evaluate all electronic tolling for permanent condition
- Consider substitute for ultra-high performance concrete (UHPC)

VE PRIORITY ITEMS SUMMARY

VE Priority Items	Priority	Justification	Project Team Recommendation	Committee Decision
Provide Shared Use Path				
Reduce path width from 12 ft to 10 ft	High	Cost Savings (\$642,900)	✗	✗
Improve Constructability				
Alternatives for Construction Phasing and MOT	High	Time and Cost Savings (\$7.85M to \$11.68M)	✓	✓
Eliminate section of Retaining Wall No. 9 (1,000 ft)	High	Cost Savings (\$700,000)	✗	✗
Micropiles on Bridge 1-706	High	Risk Management and Time Savings	Analyze	Analyze
Minimize Pinned Barrier	High	Cost Savings (\$758,000)	✓	✓

VE PRIORITY ITEMS SUMMARY

VE Recommendations	VE Priority	Justification	Project Team Recommendation	Committee Decision
Preserve Existing System				
Alternative Bridge Joint Detail	High	Extended Life Cycle (\$1.2M to \$1.4M)	✓	✓
Manage Drainage				
Smaller Temporary BMP	Low	Additional Lay Down Areas	Analyze	Analyze
Alternative pipe crossing SB I-95	Medium	Cost Savings (\$86,820)	✗	✗
Open Drainage adjacent to SUP	High	Cost Savings (\$74,250)	Analyze	Analyze
Complete on Budget				
Remove Temporary Smart Work Zone	High	Cost Savings (\$250,000)	✗	✗
Eliminate Ramp J Guardrail	Medium	Cost Savings (\$38,500)	✗	✗

VE PRIORITY ITEMS SUMMARY

VE Recommendations	VE Priority	Justification	Project Team Recommendation	Committee Decision
Optimize Material Costs				
Replace Wood Fence with Chain Link	Medium	Life Cycle Cost Savings (\$104,600)	✓	✓

VE PLAN RECOMMENDATIONS SUMMARY

VE Recommendations	Project Team Recommendation	Committee Decision
Improve Level of Service		
Coordinate construction of SR 896 widening south of interchange	✓	✓
Evaluate all electronic tolling for permanent condition	✗	✗
Improve Constructability		
Consider potential offsite laydown areas at Welcome Center, Toll Plaza, and Star Campus	✓	✓
Consider alternative project delivery and/or other contractual mechanisms	✓	✓
Consider technical recommendations regarding bridges	✓	✓
Preserve Existing System		
Confirm existing conditions for utilities, drainage and subsurface conditions	Analyze	Analyze
Evaluate LMC vs PPC overlay for existing bridges	Analyze	Analyze

VE PLAN RECOMMENDATIONS SUMMARY

VE Recommendations	Project Team Recommendation	Committee Decision
Manage Drainage		
Reduce underdrain at select ramps	✓	✓
Complete on Budget		
Review need for reinforced concrete pipe end section item	✓	✓
Add cost items to Preliminary Cost Estimate	✓	✓
Clarify E&S Items in Preliminary Cost Estimate	✓	✓
Clarify railroad services cost and construction agreement in advance	✓	✓
Consider contingent item for pile abandonment	✓	✓

VE PLAN RECOMMENDATIONS SUMMARY

VE Recommendations	Project Team Recommendation	Committee Decision
Optimize Material Costs		
Review redundancy in removal items	✓	✓
Use alternative materials in fill situations	✓	✓
Consider substitute for ultra-high performance concrete (UHPC)	✗	✗